SCIENTIFIC AMERICAN

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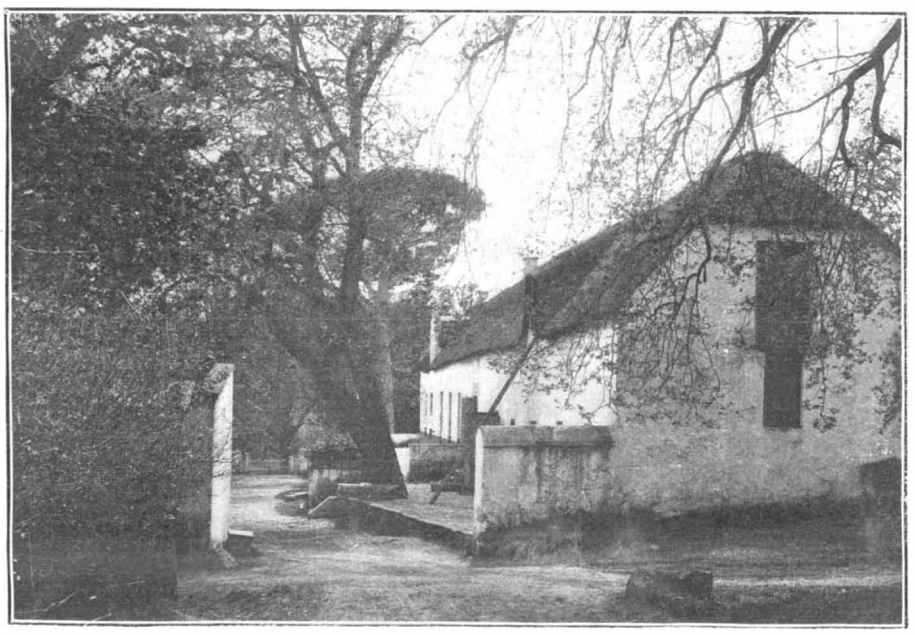
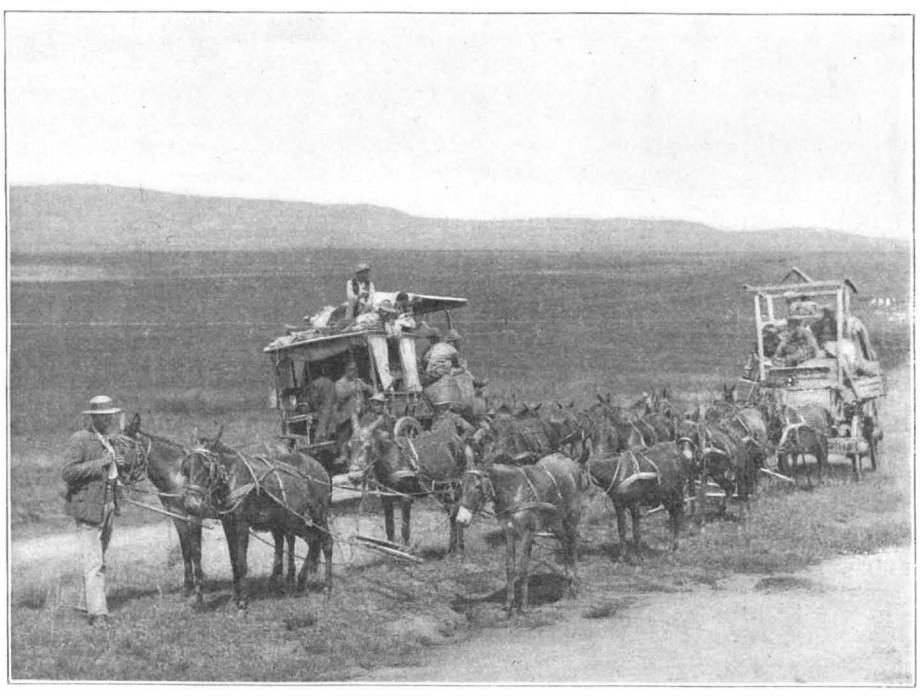


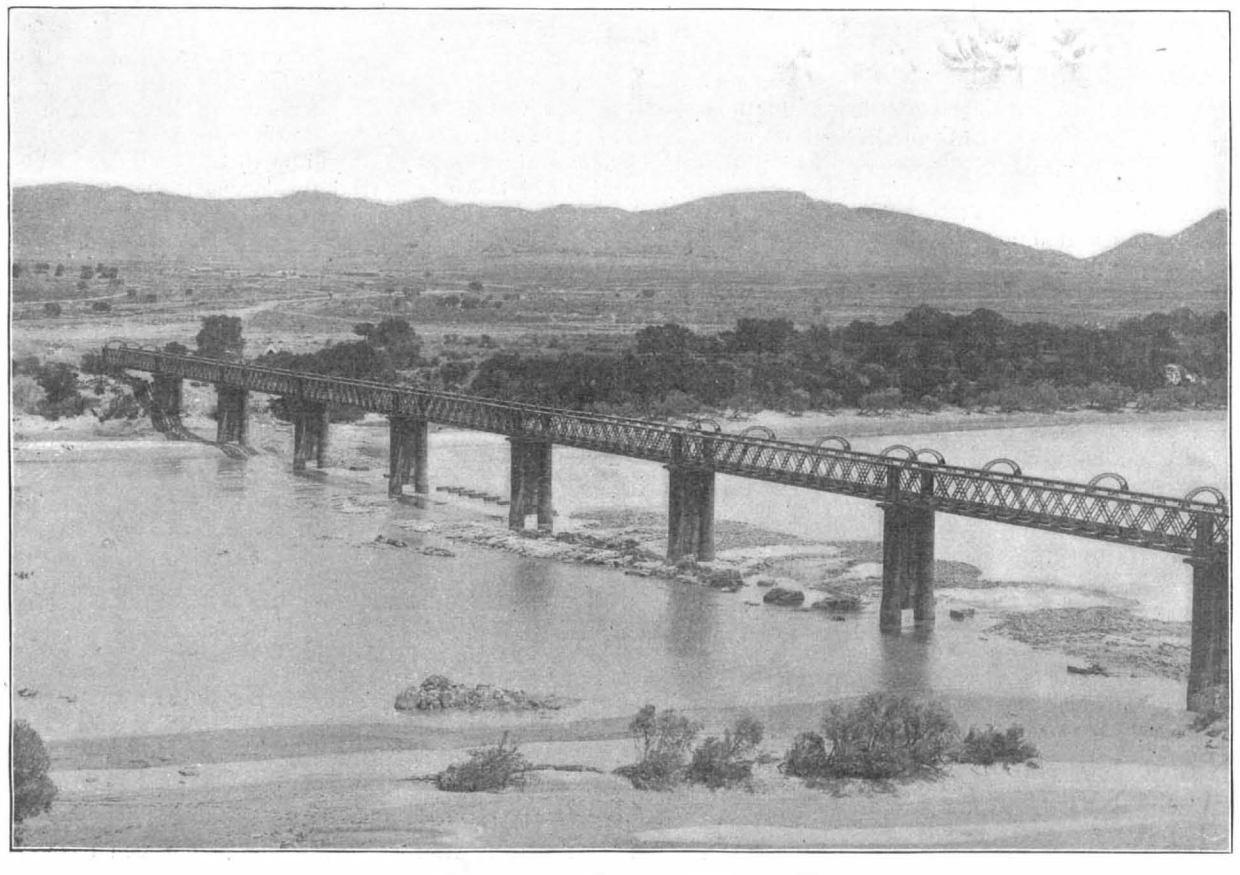
Dutch Farmhouse, Cape Colony.

Zulu Girls.

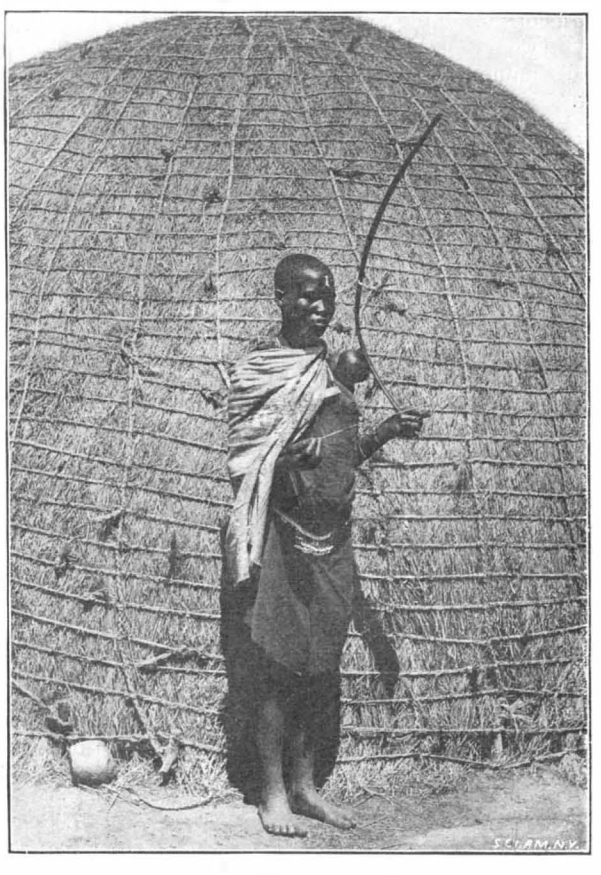
Commercial Road, Pietermaritzburg.



Traveling in South Africa—"Outspanning" a Team.



Orange River Bridge, from North Side.



Zulu Boy Playing on Okopo.

TYPICAL SCENES IN SOUTH AFRICA.—[See page 358.]

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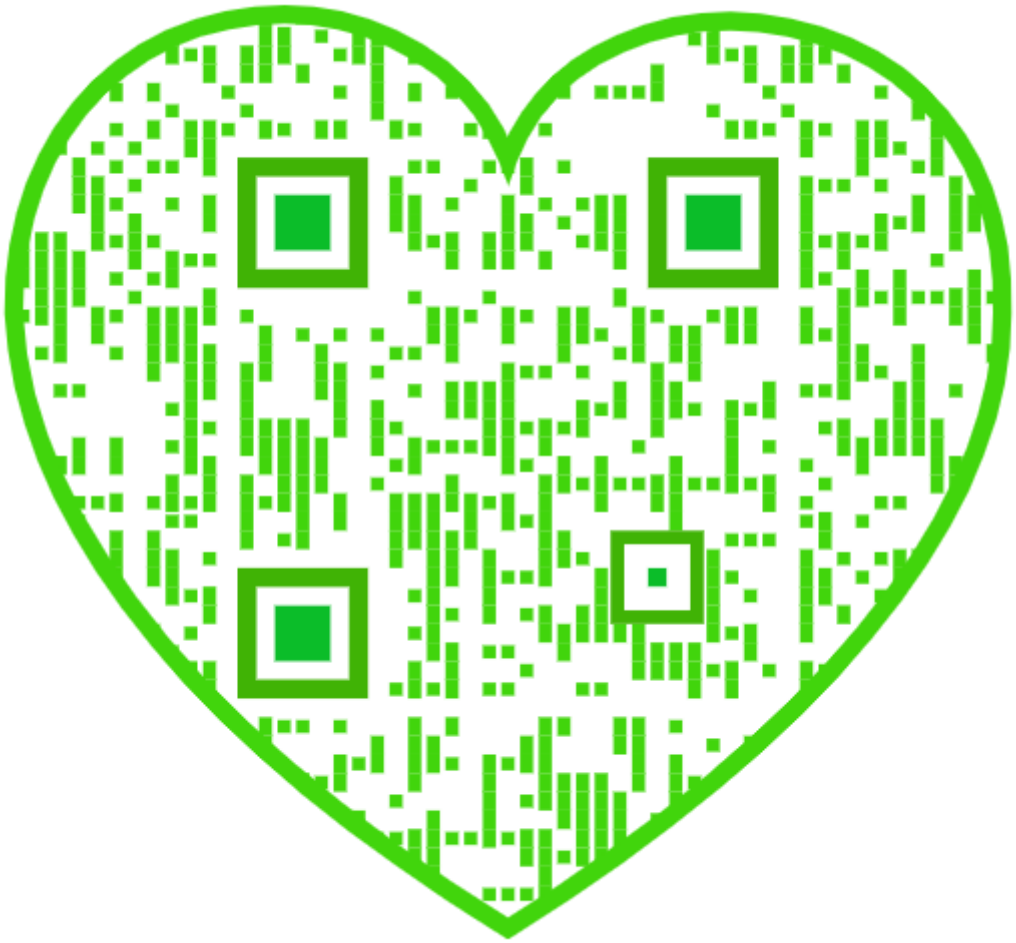

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NEW YORK, SATURDAY, DECEMBER 2, 1899.

CONGRESS AND THE NICARAGUA CANAL.

One of the greatest problems which will confront the next Congress is the Nicaragua Canal. This, if we may believe a recent dispatch from Washington, is to be pushed to the front on the opening day of the session. Representative W. P. Hepburn, who was chairman in the last House of the committee in charge of Nicaragua Canal legislation, is quoted as saying: "I shall introduce a Nicaragua Canal bill on the first day of the session;" and he evidently intends to do this in spite of the fact that the Commission appointed by the President to examine all routes across the Isthmus and decide which is the best will not have had time to present its report.

We doubt if any question of similar magnitude has come before Congress upon which so much general misapprehension exists, both in the country at large and in Congress itself; and the gentlemen who will be called upon to vote upon the subject prematurely (if Mr. Hepburn has been correctly reported) cannot do better, in the intervening time before Congress meets, than acquaint themselves with the true merits of the question. The sources of information are many and voluminous, and are to be found in the reports, official and private, that have been published. We ourselves, during the last session of Congress, published two illustrated articles (SCIENTIFIC AMERICAN, February 4 and 18, 1899) which were written with the object of placing before the public, in concise form, the respective advantages of the Nicaragua and Panama routes, which are the only two that are likely to be seriously considered by Congress.

It will be remembered that the last Congress, after considerable discussion of both routes, decided that it required fuller information, and authorized the President to appoint a committee for the purpose of investigating every possible route and deciding which it was most desirable to build. That committee is still at work and we can readily believe that a year may prove to be all too short a time in which to complete its investigation. If the report is not ready, the obvious thing to do is to wait until it is ready. To vote one million dollars for a committee to investigate and throw light upon the subject and then to ignore the committee by putting the matter to the vote before that committee has reported, is unworthy of the dignity of Congress, and is certainly not the course that will promote the interests of the country.

Before Congress votes away some $150,000,000 of the nation's money, let it at least know if it is to be wisely spent.

"A GROSS ERROR."

At the recent meeting of the Society of Naval Architects and Marine Engineers, Rear-Admiral Hichborn read a paper on the designs for the "Denver" class of cruisers, in which he referred to the criticisms to which these vessels have been subjected as follows: "One of these publications, for instance, in a prominent scientific paper, contained cuts of the vessels with certain particulars headed respectively: 'The 3,500-ton protected cruiser "New Orleans,"' and 'The proposed 3,500 ton semi-protected cruiser "Denver" and class.' It takes but a glance to discover the first gross error in this comparison, for those familiar with the facts—the 'New Orleans' having left the New York yard a short time ago, in ordinary full load condition, displacing over 4,000 tons."

The "prominent scientific paper" referred to will be recognized by our readers as the SCIENTIFIC AMERICAN; but the "gross error" of putting the displacement of the "New Orleans" at 3,500 tons is not chargeable to us, but to the annual report for 1898 of the bureau over which Admiral Hichborn presides, from which our figures were taken. In this report the displacement of the ship, "fully equipped, ready for sea, all stores on board," and with 700 tons of coal in the bunkers, is given as 3,437 tons. To allow for extra coal, due to close stowage, we raised this figure to 3,500 tons, and made our comparison accordingly, having no reason to suppose that in the official statement of the displacement of a vessel of 3,500 tons there could be a shortage of 500 tons.

We note that in the annual report for 1899, just out, the displacement of the "New Orleans" under similar conditions is set down as 3,769 tons; and now, following closely upon the issue of the report, we have the statement of the chief of the bureau that the displacement is over 4,000 tons!

Surely we may be pardoned if, in taking our figures from such an elastic source, we have fallen unwittingly into "gross error"

THE EXPLOSIVE FEATURES OF ACETYLENE.

The rapidly extending use of acetylene and the fact that its widening range of application is putting it increasingly into unskilled hands, render the question of its explosive properties a vital one to the community at large. In the earlier stages of its manufacture and use the new illuminant suffered somewhat in reputation from the recurrence of explosions more or less destructive and fatal, and there was for awhile a danger of its field of usefulness being narrowed by a popular fear as to its safety, out of proportion to the facts. Thanks, however, to exhaustive experimental work in the laboratory, the explosive possibilities of acetylene have been determined with accuracy, and it is now possible to manufacture, transport and use the new illuminant with something of the same immunity from accident that characterizes the familiar coal gas.

Pure acetylene gas, when under atmospheric pressure, is not explosive. This was proved by Berthelot and Vieille before acetylene was looked upon as having commercial value, and as soon as its production on a commercial scale became certain, they took up the question again and confirmed their earlier experiments with the following statement: "Under atmospheric pressure and at a constant pressure, acetylene does not propagate to an appreciable distance decomposition provoked at any point. Neither the electric spark nor the presence of an incandescent wire, not even the detonation of a fulminate primer, exercises any action beyond the vicinity of the region subjected directly to the heating or shock."

As the pressure of the gas rises above that of the atmosphere, it becomes liable to explode, but it is not possible to state the exact critical pressure above which a definite exciting cause will, and below which it will not, render acetylene explosive. Berthelot and Vieille state that when the exciting cause is an incandescent wire in the gas, the maximum allowable pressure is 10·5 pounds gage, and when the cause is the detonation of a fulminate cap, 3·5 pounds is the limit. These two causes of explosion were taken as representing the extreme conditions that could obtain in faulty manufacture and manipulation of the gas, the first representing intense local heating in calcium carbide attacked by a small amount of water, or caused by intense friction due to the rush of gas through a valve. The second case, which would be represented in the formation and detonation of acetylides, is not liable to occur in the commercial production of acetylene, but could only happen under special laboratory conditions.

Liquid acetylene, therefore, on account of its condensed state, is naturally susceptible to explosion, detonation being caused by high temperatures, sparks, or heavy shocks to the liquid itself. Berthelot detonated a steel bomb filled with liquefied acetylene by means of an incandescent wire, the crusher gage showing a pressure of 5,383 atmospheres; but liquefied acetylene contained in cylinders was shown by the same experimentalist to be proof against detonation by shock, a cylinder charged with 300 grammes of the liquid falling repeatedly upon a steel block from a height of 19·5 feet without explosion. A direct blow upon the liquid itself may heat a small portion to a dangerous temperature, whereas the same blow to the cylinder would be only partially transmitted, and what portion did reach the liquid would be absorbed by the whole liquid mass. A real peril exists at the cylinder and reducing valves, due to the sudden arrest of the column of gas at the reducing valve raising its temperature adiabatically to the explosion point.

Acetylene is more dangerous than illuminating gas in forming explosive mixtures with air, for not only is the ignition temperature lower, but the explosive energy is greater, and the range of the explosive proportions of the gas and air is wider. Thus a mixture of one volume of illuminating gas with one or with two volumes of air will not burn; whereas a mixture of similar proportions of acetylene gas and air burns with a sooty flame. In the case of each gas a mixture of one volume of the gas to three of the air is explosive. The strongest explosive in the case of acetylene is one to nine, and in the case of illuminating gas one to six. But whereas the latter ceases to explode at one to twelve, acetylene mixtures do not become non-explosive until the proportion is one to twenty. The temperature of ignition varies but little with the proportions of the mixture, and is placed at 900° F. for acetylene as against 1,100° F. for most combustible gases.

For a more complete discussion of the explosive possibilities of acetylene our readers are referred to an article by Frederick H. McGahie in the current number of the SUPPLEMENT.

THE YACHT "COLUMBIA" IN EUROPEAN WATERS.

After defeating decisively the fastest yacht that England could build this year, "Columbia" is to be sent across the water to try her paces in the Mediterranean, and later, during the summer months, over the various English courses. The champion of this year showed such a marked superiority over the "Shamrock" that we think the owners of "Columbia" are fully justified in making this venture. The most formidable yachts that she will have to meet on the other side are the "Shamrock," the German Emperor's "Meteor" (formerly a 90-foot cutter, now rigged as a yawl), the "Valkyrie III.," and a new 90-foot cutter which is being built from plans by Watson, the designer of the "Britannia," "Meteor" and the "Valkyries." The most formidable of these boats will be the "Shamrock" and the new Watson boat. It is possible that alterations will be made in "Shamrock," with a view to improving her qualities on a wind, though we very much doubt if she can be bettered sufficiently to overcome the present 6 to 10 minutes difference in a 15-mile beat to windward between herself and "Columbia." Probably the new Watson boat will be a more formidable competitor, and this for several reasons. In the first place, the later Watson boats have been excellent in windward work. Then again the new boat is an improved "Meteor," and "Meteor," after "Shamrock" had sailed for this side of the water, on several occasions beat "Britannia" by nearly three times as much as "Shamrock" had done, being as much as from 20 to 35 minutes better on a 40 to 50-mile course. Another circumstance which would be in favor of the new Watson boat is the fact that she is being built to race under the new English girth rule, which puts a penalty upon beam and draft, and she should gain thereby some advantage over "Columbia," which was built under a rule that puts no penalty on beam or draft. On the other hand, the Watson boat is sheathed with wood and will be handicapped by some 7 or 8 tons of dead weight. Although the new cutter may prove a troublesome competitor, we do not doubt that "Columbia" will accomplish that wholesale "capture" of English cups which was vainly attempted by "Navahoe" and "Vigilant."

CABLES OF THE NEW EAST RIVER BRIDGE.

The plans and specifications for the cables of the new East River bridge which have just been given out serve incidentally to show what a great stride has been made in the past half century in improving the quality of the materials that enter into a bridge of the suspension type. The great possibilities in the way of length of span and capacity now open to the builders of this type are chiefly due to the use of wire in place of chain cables, and to the extraordinary strength that is possessed by modern cable wire. The iron bars that made up the old chain cables possessed, probably, a tensile strength not exceeding 25 tons to the square inch, and they were open to the suspicion that attached in early days to welded members. The steel wire cables of the East River bridge will have a tensile strength of 100 tons to the square inch, or just four times as much as the old iron chains.

THE NEW NAVAL PROGRAMME.

Secretary Long and the Board of Naval Construction are to be congratulated on the new programme of naval construction, which calls for the construction of eighteen vessels with an aggregate displacement of 75,300 tons, to cost exclusive of armor about $26,000,000. The most important ships will be three great armored cruisers of 13,500 tons trial displacement, with high speed, unusually large coal supply, and powerful armament. They will differ but little from the armored cruisers "California," "Nebraska," and "West Virginia," vessels of 15,500 tons displacement, authorized by the last Congress. These vessels will combine the offensive and defensive qualities of the battleship with the speed and radius of action of the cruiser. If, as is suggested, they are to carry the 10-inch gun in their main battery, they will mount a more powerful weapon than the latest German battleships, whose largest gun is of 9·45 inches caliber. The programme also provides for three 8,000 ton protected cruisers, which are to be improved "Olympias," the increased displacement being devoted to larger supplies of coal, ammunition, and stores, and a larger crew, all of these additions being necessary to meet the long-distance cruises required by the extension of our foreign possessions. The third class of ships will consist of twelve sea-going, light-draught gunboats of 900 tons, to have the highest speed compatible with good cruising qualities and great radius of action. The presence of these vessels on the programme is due to the recommendation of Admiral Dewey, who considers them necessary for the proper patrol of the Philippines. They are to be patterned broadly after the "Wheeling," but will be of several feet less draft.

The programme is admirably adapted to meet the

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necessities of the navy, the new armored cruisers serving to bring this splendid type of ship up to the desired number to match our fleet of battleships.

THE MONUMENT TO ROBERT FULTON.

The world at large, and even many of those who are interested in the history of mechanical engineering, do not know that the body of the great engineer, Robert Fulton, lies in Trinity churchyard in New York city, being interred in the Livingston family vault. There is no mark or inscription to indicate its resting place. In view of the epoch-making character of the work of Fulton, and of his eminence as an engineer, and of his indomitable perseverance in the development of steam navigation in the face of the greatest obstacles, it has been deemed desirable that his tomb should be marked by a suitable monument. The Council of the American Society of Mechanical Engineers had the matter brought to its attention at the Washington meeting last May. The idea was warmly welcomed, and a committee was appointed to investigate the proper method of accomplishing the suitable marking of the grave. The committee has found its efforts heartily met both by the Trinity corporation and by members of the Fulton family. The society has been assured that a suitable place will be provided in Trinity churchyard for such a monument as may be erected, and that the remains of Fulton will be removed to such a place when the monument is ready. The Society possesses a number of memorials of Robert Fulton, including furniture, his portrait by his own hand, drawings, autograph letters, and other personal relics. Indeed, it may be said that the Society is Fulton's literary heir. In view of this fact, the action of the society is most dignified and fitting. A subscription is now being raised by it, and there is little question that sufficient funds will be obtained to erect a most admirable memorial to mark the place where lies the body of one of the earliest and greatest of American engineers.

It is poetic justice that Fulton should continue to rest in the spot where he was interred. At the front of the quaint old burying ground run the cable cars, at the rear the electric cars and the elevated road, and at the foot of Rector Street, the other boundary, two of the fastest vessels on the bay make their landings. Almost across the street is one of the tallest buildings which has ever been erected, and Wall Street commences directly in front of the burying ground. What more fitting spot could be obtained for the resting place of one whose activities contributed in so large a degree to the progress which is so much in evidence immediately around the historic old church?

THE HEAVENS IN DECEMBER.

BY GARRETT P. SERVISS.

Those who watched for the November meteors saw the starry sky at midnight last month wearing nearly the aspect which it has at an earlier hour of the night in the middle of December. Each month sees the heavens advance from east toward west about 30°, equivalent to the length of one of the signs of the zodiac. But the same advance can be beheld in the course of two hours watching on any single night. Thus the observer of the heavens at 10 o'clock P. M. by waiting until midnight can see them as they will appear at 10 P. M. one month later. At 10 o'clock in the middle of December Orion is in the east, dominating all that quarter of the sky, while Sirius flames between him and the horizon. It is worth while to study the appearance of Sirius while the star is yet comparatively low in the east. At such times it possesses a beauty of shifting color which it entirely lacks when seen near the meridian. The rapid play of prismatic hues is indescribably splendid. If the Kohinoor could be hung up against a black background a hundred yards away with an electric light concealed behind it and transfusing it with fire, the appearance might possibly rival that of Sirius rising through an unsteady atmosphere on a clear December night.

While Orion and Taurus rule the east, Eridanus, the great river of the sky, with its curious winding streams of stars, stretches westward from Orion's feet and crosses the meridian. Cetus, broad and formless, hiding the wonderful variable Mira in its folds of dark sky, occupies a large part of the southwestern quarter, with Pisces and Aries high above it near the midheaven. At the same time Perseus, with his gorgeous sword hilt, composed of matted stars in one of the thickest parts of the Milky Way, shines north of the zenith, while Andromeda lies stretched along the sky westward, the W of Cassiopeia glittering between her and the pole. In the northeast Leo follows Gemini up the star-sprinkled slope between the horizon and the meridian. The Great Bear, Ursa Major, appears in the northeast standing on his tail. The Milky Way crosses the dome of the sky from southeast to northwest.

THE PLANETS.

Mercury plays a double role in December, being an evening star at the beginning of the month and a morning star at the end. It is not visible, however, in the evening, being too near the sun. It passes behind the sun on the 5th, and, emerging in the morning sky, reaches its greatest western elongation on the 25th, about which time it will be quite a conspicuous object in the morning twilight. Mercury is in the constellation Ophiuchus.

Venus is beginning to assume her place as the evening star, which, when she occupies it, admits no rival. She can be seen in the flood of sunset light at the opening of December, but she will appear more beautiful at the close of the month, when she will linger above the horizon more than two hours after the sun has set. She is moving swiftly eastward among the stars, passing during the month from Sagittarius into Capricornus.

Mars, almost lost in the solar rays at the beginning of the month, and entirely so before the end, plays an unnoticed part as an evening star. In fact, Mars may almost be said to have lost his popularity of late. During the last opposition comparatively little was seen of the puzzling system of streaks called canals, which have given birth to so many fancies concerning Mars, and almost nothing new seems to have been learned. It is true that the planet was not well situated for observations, but at the same time disappointment has been felt over the meager results obtained. Mars is in the constellation Ophiuchus, from which he passes into Sagittarius.

Jupiter is a morning star in Libra, rapidly increasing its distance from the sun, and sufficient by its sole presence to give an air of occupation and planetary distinction to the before-sunrise sky. At the end of the month it will be about two moon-breadths from the well-known double star Beta in the constellation Scorpio. Jupiter continues to hold the attention of observers by the wonderful evidences which its ever-shifting belts and spots furnish of the grand scale on which its ceaseless changes are taking place. This emergence of a planet from chaos, for that much the phenomena of Jupiter may be regarded as indicating, is certainly a fascinating spectacle. The markings on Jupiter, with their often beautiful colors, are so easy to see that the great planet offers a rich field for amateur telescopists, and with a good four or five inch glass any industrious observer, watching Jupiter, can learn for himself, through the testimony of his own eyes, things which will, at the same time, widen his view of the origin and growth of worlds and stimulate his appetite for science. With Jupiter brightening in the morning and Venus in the evening sky, there is enough of promise to awaken the enthusiasm of all lovers of astronomy, and later in the winter, when these two leaders of the starry host have really begun their reign, there will be a carnival of telescopes.

Saturn, concealing its pageantry of rings and satellites in the glare of sunlight, passes from the evening into the morning sky on December 17. Like Mars, it remains during the entire month too near the solar orb to be seen. It is in Ophiuchus and moves thence into Sagittarius.

Uranus is also a morning star in the conste lation Ophiuchus, a few degrees north of the bright red star Antares in Scorpio.

Neptune in Taurus, close to the border of Gemini, and above the head of Orion, is in opposition to the sun on December 17, the same date on which Saturn is in conjunction with the sun.

THE MOON.

New moon in December occurs on the morning of the 3d, first quarter on the morning of the 10th, full moon on the morning of the 17th, and last quarter on evening of the 24th. The moon is nearest the earth on the 7th and farthest off on the 22d.

There are two eclipses in December, an annular eclipse of the sun, visible only around the south pole, on the 2d, and a nearly total eclipse of the sun, visible generally in this country on the evening of the 16th.

COMPRESSED CORK AND ITS USES.

Cork, as everyone knows, is one of the best non-conductors of heat or sound. That it has not been more widely used in building is due chiefly to the difficulty of obtaining it in an unadulterated form. A product called cork tiling has recently been placed upon the market which is made of what is known to the trade as "virgin cork," ground, compressed, and otherwise treated by a patented process, and which is free from the cement and glue usually employed to hold the particles together. We are informed that tiles made of this pure, compressed cork form an admirable flooring, which, besides being noiseless, water-proof, warm, and germ-proof, is capable of withstanding hard usage. By varying the degree of compression and modifying the manufacturing process slightly, sheets of cork different in color and density are obtained, which, when sawed and finished in the form of panels, can be used for wainscoting alone, or in connection with cork-tile floors. Cork compressed into sheets and sawed to the size and thickness desired constitutes a very efficient pulley covering. It is said that a pulley covered or lagged with compressed cork will transmit from 50 to 60 per cent more power with the same tension of belt than one having only a smooth iron surface.

AMERICAN FRUITS AT THE PARIS EXPOSITION.

Under the supervision of the Division of Pomology of the Department of Agriculture, arrangements are being perfected whereby the exhibition of fresh fruits from this country to the Paris Exposition next year will be the most effective and elaborate ever attempted. Mr. W. T. Taylor, Assistant Chief of the Division, recently had this to say of the preparations already made

"At Paris there will be 250 barrels of choice American apples in cold storage, small lots being taken from the supply from time to time as needed to keep up a continuous fresh fruit exhibit. Oranges will be treated in the same manner. Apples we are making the leader, as being the most widely grown and most valuable fruit for export trade. More perishable fresh fruit will be shipped regularly, affording, also, a continuous exhibit. California, for instance, has arranged to send over every week a supply of fresh perishable fruit, such as grapes, plums, apricots, figs, peaches, etc. We wish to show not only that America can produce the finest fruit in the world, but that foreigners will not assume much risk from plant disease or insects in importing our fruits for general use."

A prominent feature of the Department's exhibit will be its photographs, those in practical horticulture and agriculture being especially striking. The miracles wrought in our arid lands of the West by the large irrigation systems now so successfully in operation there, with views of the mammoth crops and orchards growing on irrigated land, while the immediately surrounding and unwatered land is seen to be only sparsely covered with scrub and sage brush, will be among the most interesting of these photographic evidences of the activity and worth of the Department's work. The ornamental tree, shrubbery and horticultural systems of some of our great railroads, at their suburban and village stations, as well as the results of the competitive prize offerings of the large factories for cultivations in their own and operatives' grounds, in some of our more modern co-operative towns, will also be prime features.

The canned and dried fruit and nut exhibits will also be under the care of the Division of Pomology, and everything is to be done to prove to Europeans how very little they yet realize of the possibilities of procuring from America, as articles of every-day consumption, what are now regarded by them as only luxuries for the wealthy.

CAN WHITE MEN LIVE IN THE TROPICS?

Benjamin Kidd, who is well known for his writings on social subjects in the tropics, has recently published a series of articles which attempt to show that it is impossible for white men to become acclimatized in the tropics. He goes on to say that all of the attempts to reverse by any effort within human range the long, slow process of evolution which has produced such a profound dividing line between the inhabitants of the tropics and those of temperate regions will end in failure. Dr. Sanborn, on the other hand, has shown that the causes of disease, deterioration and death in the tropics are due to pathogenic germs which have their limited and peculiar geographic areas, and differ greatly in the various tropical regions. Of course, if heat were the difficulty in the way, acclimatization would be altogether hopeless. There appears to be good reason, however, to believe that the real difficulty is the microbe; and if so, we may hope to fight against it in the tropics as successfully as has already been done in the temperate zones by sanitation and the gradual acquisition of immunity. The Medical News quotes Dr. Manson, who has written a book on this subject, and Dr. Rho, of the Italian navy, who also believes in the possibility of tropical acclimatization. The death rate of European troops in the tropics, which used to be from 100 to 129 per thousand, is now as low as 12 per thousand in India. The death rate of Spaniards in Cuba is less than in Spain.

DEATH OF SIR WILLIAM DAWSON.

Sir William Dawson, the late principal of McGill College, Montreal, Canada, and one of the most celebrated geologists of modern times, died November 19. He was born in Nova Scotia in 1820, and after studying at the University of Edinburgh returned home and devoted himself to the natural history and geology of Nova Scotia and New Brunswick. He embodied these investigations in his "Acadian Geology." In 1842 and 1852 he accompanied Sir Charles Lyell in his explorations. His title to fame rests perhaps more upon the discovery of the Eozoon Canadense of the Laurentian limestone, the oldest form of animal life, than upon any other discoveries or researches which he made. He was a very prolific writer upon geological subjects, and he has appeared as a scientific lecturer in the U. S. He was a Companion of the Order of St. Michael and St. George and was appointed president of the Royal Society of Canada, and in 1884 he was knighted. In 1886 he was president of the British Association. The Montreal meeting was the first ever held out of the British Isles.

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THE TIDAL "BORE" AT MONCTON.

BY GUSTAV KOBBÉ.

The "bore" at Moncton, N. B., about 130 miles from the mouth of the Bay of Fundy, is a tidal wave which, in the twinkling of an eye, converts a rent of mud in the landscape into a broad, navigable river. This happens each flood tide. With the ebb the twelve miles of river over which the "bore" sweeps, again become a reach of mud and slime.

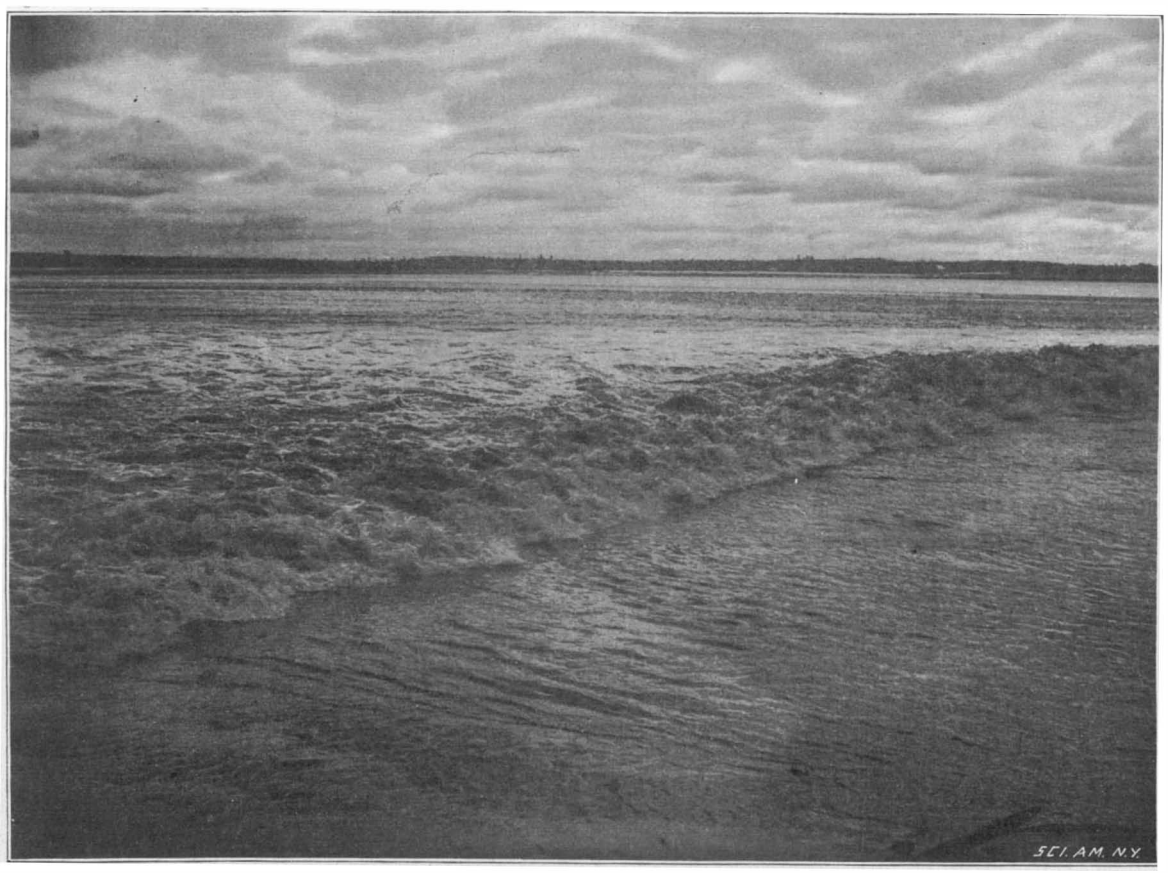
The "bore" is the final and climacteric act in each flood tide of the Bay of Fundy. There is one phenomenon more picturesque, the reversible tidal falls at St. John, N. B., but none is so dramatic or more in keeping with what the climax of a great tidal rise should be. In height, velocity and roar the "bore" fulfills all these conditions.

The Bay of Fundy is, roughly speaking, one hundred and seventy miles long and from thirty to fifty wide. It lies like a narrowing trough between Maine and the provinces of Nova Scotia and New Brunswick. The heaping up of waters in this natural trough is believed to account for the extraordinary tidal phenomena. The various headwaters of the bay are themselves Bays of Fundy in miniature, with the result that, as we proceed up the bay, the tidal phenomena repeat themselves on a steadily enlarging scale. Thus, the nearer we draw to the headwaters the greater the rise of tide; until the climax is reached at Moncton with a "bore" and a tidal rise and fall of seventy feet.

This explanation of the extraordinary tides of the Bay of Fundy, attributing them to the troughlike shape of the bay, is, I believe, widely accepted. There seems none other feasible. The bay itself lies at the head of a series of great bights in the Atlantic coast, so that, when the tide reaches its mouth, there has already been a great upheaping of waters upon which the troughlike shape of Fundy has a cumulative effect as the tide streams up the bay.

It is interesting to follow the tide from its beginning to its climax at Moncton. It affects not only the landscape of the bay, but also the industries which are followed there. For instance, dry docks hardly are needed in the Bay of Fundy. If a vessel is anchored in deep water at flood tide, she will probably be high and dry before half the ebb, and there will be time to scrape and clean her and to make other repairs before the flood lifts her again.

LOW TIDE ON THE PETITCODIAC RIVER, AT MONCTON, N. B.



THE RUSH OF WATERS, OR THE "BORE," FIVE FEET FOUR INCHES HIGH, AT MONCTON, N. B.

Near the mouth of the bay and athwart it, like a huge bolt of rock, lies the beetling island of Grand Manan. Here the rise and fall of the tide is about fifteen feet. At low tide there are numerous rocky islets, which are swallowed up by the flood. Seaward are echelons of rocky ledges, and the effect of these on the tide is to increase its velocity, so that not infrequently ships are unable to stem it and are obliged to beat about the mouth of the bay for hours, even when the wind is fair. There are many days of thick fog in the Bay of Fundy, and often I have stood on the high cliffs of Grand Manan watching the topsails of ships above the mist. The effect was ghostly and weird. It seemed as if a phantom fleet were cruising below.

On one occasion I went out fishing in a rowboat. A few rods from shore we scraped bottom on a rock. Some hours later, as we were returning, the boatman pointed to a high rock, at least twenty feet out of water. "That is the rock we touched," he said. The scene was completely transformed. Small craft, the anchors of which had apparently been thrown out on shore, were dangling by their cables from rocky eminences. The wharf where the little steamer had landed me stood, slime-stained, amid a lot of seaweed-covered stones. The steamer was anchored well out in the bay.

The strength of the tidal rush adds to the force of the waves and on some of the headlands strange shapes have been carved from the rocks by the water. At the very end of a picturesque ledge, jutting from the cliffs at the southern end of Grand Manan, is the perfect figure of a cross worn from the solid rock and standing erect on the ledge as if it had been built there. I once saw a white sea-gull hover above and perch upon this cross. The day was tranquil, the waves sunlit and murmuring faintly against the base of the cliff: and the southern cross with the white gull perched upon it gave a wonderful sense of peace to the scene.

Curiously enough, at the other extremity of the island, the waves have carved another symbol of religion—the rock there resembling so closely a bishop's miter that it is called the bishop.

But the greatest effect of combined wave and tide action is what is known as the seven days' work on the west shore of Grand Manan. This is a seawall several miles in length and composed of huge bowlders. It is a giant's causeway built by the tides of the Bay of Fundy, and forming an entirely artificial shore line with here and there a little pond where the waters of the bay have percolated or where a brook comes down the slope of the island and spreads out behind the seawall.

There are fish weirs at Grand Manan, but in no such number as further up the bay around Lubec, Eastport, and Campobello, where the rise and fall of the tide is about 25 feet. The fish swim into these weirs at high water, and being unable to find the way out, because, once in the weir, they swim in a circle, and thus miss the narrow entrance, the fishermen have only to enter the weir at low tide, and scoop up the catch. The tide is thus made tributary to an important industry. Most of the fish caught in these weirs are herring which are put up as sardines at the many factories near Eastport. About a billion a year are canned, and the industry affords occupation to many besides the fishermen.

It is considered great sport to launch boats and small vessels on the wake of the bore, be carried swiftly up stream, with no exertion beyond steering, and come down on the ebb. A schooner, the stern of which protruded from one of the wharves, was torn from her moorings by the bore, had her masts snapped by a bridge under which she was carried, and her bow smashed. Altogether, the "bore" belies its name; for it makes things rather lively for the otherwise slow town of Moncton.

New Process of Making Photographic Reliefs.

A new process of photography in relief upon glass, porcelain, etc., has been lately discovered by M. Sekutowicz. He transforms by a direct process a photographic film into a photoplastic relief, which may be used in the molding of glass and in analogous processes. The experimenter happened upon the discovery in the following manner. Having had occasion to reinforce a negative film in a solution of mercury bichloride, he found that the film then presented a surface having greater relief than usual. In searching for the cause of this action he discovered that the solution had been very much too strong, owing to a mistake in weighing. Upon repeating the experiment the phenomenon again appeared, and by varying the strength of the solutions he obtained a series of reliefs in proportion to the degree of concentration of the bath. After demonstrating this fact he at once proceeded to utilize the discovery, and first obtained a plaster impression in the following manner. The film in relief, while wet, is placed upon a block of fine plaster having a plane surface, this having been previously moistened. The formation of air bubbles between the film and the plaster should be carefully avoided. At the end of a few minutes the excess of water is absorbed by the plaster and the film remains fixed flat upon its support, the side in relief being uppermost. A layer of plaster is then flowed over this in the usual way and a reproduction is thus made, which is treated by the galvanoplastic process. In this way a mold is formed, which may be applied to various industrial uses, such as impression in relief upon glass or porcelain, and also in the different processes of photo-printing, and the discovery of M. Sekutowicz will no doubt prove of considerable value in these and analogous processes.

THE use of silicate of soda in refining heavy petroleums has been recommended. It is useful in making from spindle to cylinder oils. The silicate is used as a neutralizing agent after treatment with sulphuric acid and is said to be highly efficacious. It may be used either alone or in connection with caustic soda.

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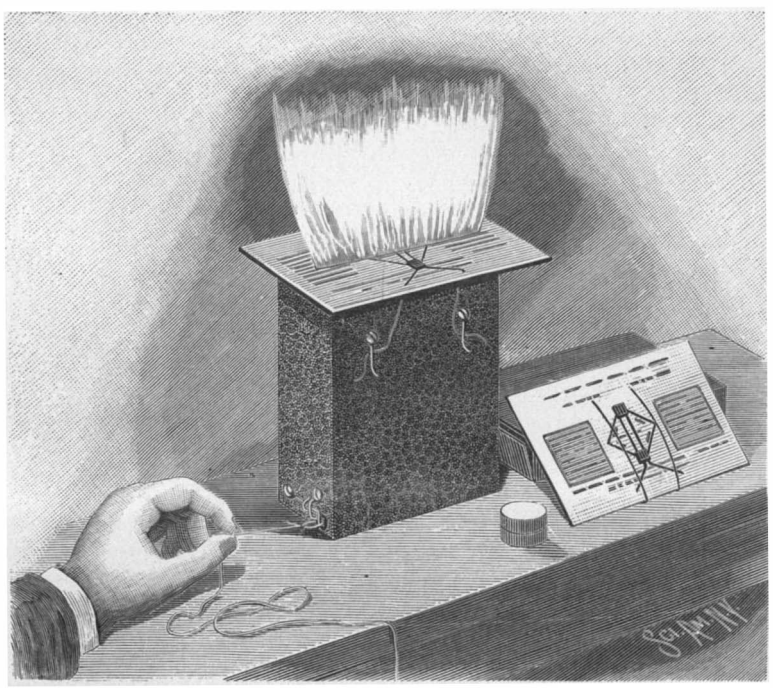
AN ELECTRIC FLASH-LIGHT DEVICE.

Various forms of lamps and devices for igniting flash-light magnesium compounds intended for photographic purposes have been invented during the past few years, several of which have been constructed in such a way as to promote the element of safety, for it is well known the setting off of a flash powder is accompanied with more or less danger, and usually more than ordinary care is required.

The object of the electric flash-lamp, shown in the accompanying engraving, is to provide a perfectly safe lamp and one that is also effective, convenient to operate, and light to carry about.

It consists of two cells of a powerful dry battery inclosed in a box suitably connected up in circuit, one part of the circuit being connected to two screws with spring fingers attached, as will be observed on the broad side, and similar screws at the bottom, at the narrow end. From one screw is a light spring wire, having a loop in its end, to which a string is attached. From the other screw projects a hook-shaped shorter rigid wire. When the spring wire is pulled forward by the string, it brings both terminals into electrical contact. To the right of the box is a flash-card, having two fine wires on the surface arranged in diamond form and having in their circuit a minute platinum fuse. The card is placed on the box, and the wire terminals are slipped under the two spring wires, which completes the electrical circuit. The flash powder, in a small, round box, is poured out on the card in the diamond-shaped space in such a way that some of it comes in contact with the platinum fuse. To ignite the powder it is only necessary to close the electrical circuit by pulling lightly on the string, which brings the two wire terminals at the bottom into contact, causing the electric current to heat the platinum fuse to redness and instantly fire the powder. The operation is extremely simple, and enables one to remain at some distance from the flash and even to be included in the picture, as it is evident that the length of the string can be adjusted to suit the circumstances.



A SIMPLE ELECTRIC FLASH-LIGHT LAMP.

With a light of this kind it is an easy matter to take instantaneous interior daylight photographs of children and infants. Placing them near a window, the camera is adjusted on a stand and focused. The flash-light may be located six or eight feet from the subject, arranged to illuminate the shadow side of the face. The shutter of the camera may be set at a very slow speed. Taking the operating bulb of the camera in one hand and the string of the flash lamp in the other, the photographer can set off both at the same time, compressing the shutter bulb with the right and pulling the string with the left hand. The intensity of the shadow side may be varied by the distance of the light from the subject. Very soft and pleasing children's portraits may be made in this way. But flash-light pictures at night can be made perfectly, and in large rooms duplicate sets of light can be arranged to flash at once and thereby give proper illumination. The device has also the merit of being inexpensive, which will commend it to many.

We are informed that Himmer & Potter, of No. 168 Greenwich Street, New York, are the manufacturers of this convenient article.

Repairs to the Crystal Palace.

Extensive repairs are in progress on the Crystal Palace, at Sydenham, near London. The glass in the whole of the Central Transept is being replaced, the area to be covered measuring nearly two acres. It is interesting to note that the proportions of the original structure were largely controlled by the size of the glass which it was possible to obtain in large quantities in the exhibition year, 1851. The maximum length then commercially practicable proved to be forty-nine inches. The glass originally used was a sixteen-ounce quality, and the strips were ten inches wide and fitted into grooves in wooden sash bars. It was originally intended to use putty, but the machine devised for puttying these sashes proved unworkable, and the plan was then adopted of passing the bars through a tank of thick paint. This paint was automatically scraped off the surface of the bars as they were removed, but the grooves into which the glass was to fit remained full, and, on drying, made a watertight joint between the glass and the sash bar. The joint was really too good from the point of view of the firm who took up the contract for moving the Exhibition building, for it was practically impossible to break the joint without at the same time smashing the glass. When re-erected at Sydenham a twenty-one ounce glass was substituted for the one originally used, but the methods of construction and the size of the sheet were unaltered. In the present repairs twenty-six and thirty-two ounce glass is being used. The sheets measure 51 × 18 inches. Steel sash bars are being substituted, and they are covered with a special section of tinned lead, and the glass put in place is secured by bending down long flaps of the alloy.

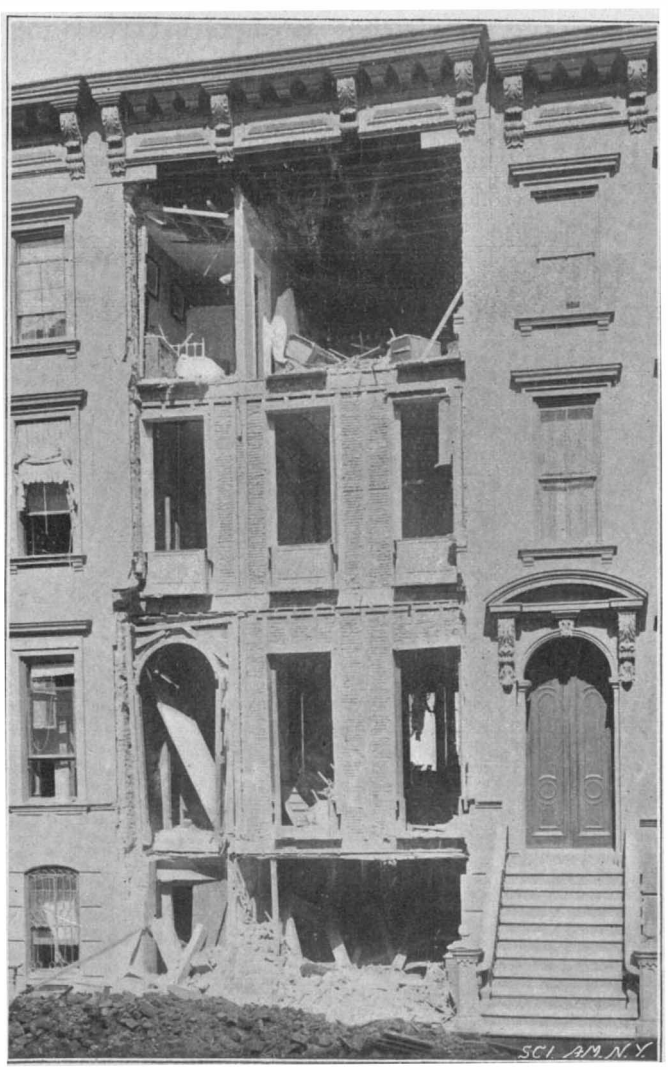
The Largest Patent Office Gazette.

The current issue of The Patent Office Gazette, Vol. 89, No. 8, bearing date Tuesday, November 21, 1899, is the largest ever issued. There are 321 pages of drawings and claims, which record 535 patents, 59 of which are in one classification, and all but 4 of these are granted to one applicant. The 59 patents alone contain 1,593 claims. The work of printing this number of the Gazette was so heavy that it required an extra force of men to allow of its being issued on schedule time.

A DESTRUCTIVE GAS EXPLOSION.

A terrible gas explosion, followed by a number of minor explosions, recently destroyed a three-story private house in East Fifty-sixth Street, New York city. One man lost his life, several persons were injured, and the adjacent and opposite dwellings damaged. The owner of the house and his family were traveling abroad, and during their absence the rooms were being renovated and redecorated.

The theory advanced to account for the terrible accident is that gas had escaped from the main and had found its way into the house through crevices in the earth. Every door and window being closed, an excellent opportunity was presented for the accumulation of a large volume of gas, which would explode on communication with the first flame. How destructive was the explosion and how great the havoc wrought is well shown by our illustration, reproduced from a photograph taken on the following day. The interior of the house was completely ruined. The front and rear portions were blown out; the floors and walls suffered terribly, and the windows in the opposite dwellings were shattered by the flying pieces of stone. After the explosion the street was rendered impassable by the debris.



GAS EXPLOSION IN A RESIDENCE IN NEW YORK CITY.

The condition of the ruined house and the fact that there were several explosions lead to the conclusion that the greatest volume of gas had accumulated in the cellar and basement. Here the main explosion probably occurred, followed by successive explosions in the upper stories and the collapse of the front and rear walls.

Permanganate of Potassium as an Antidote.

The powerful oxidizing properties of permanganate of potassium have rendered it valuable as an antiseptic and disinfectant, but its properties as an antidote for various poisons are not so generally known. It has been prescribed with success by Bokai and other physicians in the case of phosphorus, which it transforms into orthophosphoric acid. It has been used by Autail for oxalic and hydrocyanic acids and their salts as well as for strychnine and other vegetable alkaloids. Pyle Koelner has employed it in the case of poisoning by opium, and Lacerda for serpent bites and those of venomous insects, spiders, etc. Several years ago the physician Hugoneng showed its action against atropine, aconitine, caffeine, cocainine, etc. In a recent work, an Italian physician, Paratore, has remarked its effect upon the vegetable alkaloids such as nicotine and aconitine and also upon the vegetable poison curare. He has studied its action in cases of poisoning by strychnine, comparing it with the usual antidotes such as tannin and iodine. As a result of his researches he finds that the permanganate is superior to the others, whether employed in direct injection or in cleansing of the stomach.

A New Reproductive Process for Pictures.

An association has been formed in Germany called "The Union of Friends of Art for the Official Publication of the Royal National Galleries." As its name implies, the society is the vehicle for distributing among the educational and religious institutions of Germany and the people in general facsimile copies in colors of the great masterpieces and famous paintings in the royal galleries in Europe, thus planting the seeds of art education in the minds of the rising generation. The society enjoys great popularity, and success has crowned its efforts. The superiority of the prints is due in the main to the peculiar process which the society owns and which is employed by it alone. In time it will be introduced in the United States. It differs in its method from any heretofore employed, as it enables the reproducing artists not only to create true facsimiles of originals by means of photography and steel etching, but also to produce the depth of color and peculiarities of manner of each master. The process, while an intricate and costly one, is not patented, but the details are kept a strict secret. After the original paintings have been photographed with the aid of special cameras and plates, the photographs are transferred to steel plates, the surface of which by some peculiar treatment has been prepared to receive the impressions from the negative. The outline is thus obtained upon the steel with great exactitude. The colors, as true to the original painting in the distribution of light and shade as manipulation of the brushes of eminent artists can make them, have been reproduced on the photographic copy first obtained, and the complex color picture thus created is transferred to as many lithographic stones as there are colors represented in the picture, from which impressions are taken on presses worked by hand. The greatest care is used in the choice of subjects for reproduction.

THE Board of Health at Plainfield is considering the question of adopting a rule which will prohibit the burning of leaves within the city limits, as it is claimed that the practice is conducive to much ill health during the fall season. Several physicians have said that the smoke and smudge which comes from burning leaves is the cause of many of the ailments of the throat, lungs and eyes.

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THE FUTURE OF SOUTH AFRICA.—II.

BY EDGAR MELS, FORMERLY EDITOR OF THE JOHANNESBURG DAILY NEWS.

Having thus, in my previous article, outlined briefly the status of commerce in South Africa, a word about the resources and topography of the country will not be amiss.

The southern end of Africa is of volcanic origin, as is proved by the diamond mines in Griqualand West, which are really extinct craters. From the coast to a hundred or more miles inland the country is fairly fertile and studded with undulating hills admirably adapted for vineyards. Beyond this fertile belt lies the Hinterland veldt—level plains sparsely covered with short grass and dotted here and there by the karoo bush, a stunted tree from a foot to eighteen inches high. Here thousands of sheep and cattle graze, living in comparative luxury on the leaves of the nutritious karoo.

Back of this comes the plateau, some five thousand feet above the sea. It is on this eminence that the gold mines are situated. These, too, are of volcanic origin, tremendous physical upheavals having produced the peculiar conglomerate quartz, called banket, in which the gold is found. Again, further inland, is another plateau, rich in minerals and splendidly adapted for cattle raising.

Minerally, South Africa is the richest country in the world. Every mineral known to science can be found there. Diamonds being the most valuable come first. Leaving aside the Kimberley and the Jaegersfontein (Free State) mines, the precious stones are also to be found in the Vaal River, seventy miles from Kimberley; near Klerksdorp, in the Transvaal; in Zebedili's country, north of Pretoria; in the Zoutpansburg district, and in the Blaauwberg Mountains. Rhodesia is closed territory as far as diamonds are concerned, for Mr. Rhodes, as managing director of the De Beers Diamond Mining Company, made a contract with himself as the managing director of the British South Africa Company, Chartered, giving himself the exclusive right to mine diamonds in Rhodesia for "obligations rendered."

Gold has been found in Southern Africa since time immemorial, and Mashonaland is popularly supposed to be the Land of Ophir mentioned in the Bible. In modern times gold was first found by Arabs as early as 1500. Now it is found at Johannesburg, Klerksdorp, Barberton and Krugersdorp, in Swazieland, at Knysa, at Potchefstrom, in Zululand, Damaraland and Namaqualand, in Rhodesia, and a dozen other spots. The only alluvial gold worth mining is that at Lydenburg.

Coal is found in the Cape Colony in half a dozen places: in Natal, near Dundee; in Zululand, twenty-five miles from St. Lucia Bay; in the Orange Free State, near Kronstadt and Viljoen's Drift; in the Transvaal, at Klerksdorp and Vereenigung and at Boksburg; and in Rhodesia on both banks of the Zambesi. The approximate output of the coal fields in 1898 was nearly two million tons.

Silver is found all over South Africa, but the only mines in operation are those near Pretoria. The official reports of the Transvaal state that the best veins are from two to four feet wide, assaying forty-five ounces of silver and ten per cent of copper to the ton of ore. Under the present system of working, each ton of ore produces $13.50. The Marico mines, near Zeerust, assay sixty ounces of silver to the ton, but cannot be worked with profit, owing to a lack of coke.

Copper is found in Namaqualand, where it has been mined since the seventeenth century. About thirty thousand tons of ore were shipped to England for smelting last year, the value being about $70 per ton. Large deposits of copper have also been found in Mashonaland. The principal mines are those of the Cape Copper Company, which made an estimated profit of nearly half a million dollars last year.

Lead is found in connection with other metals in all parts of the country. Zinc exists in the Malmani district, and antimony near Barberton and in the Zoutpansburg. Tin is mined in payable quantities in Swazieland, twenty-one pounds of pure tin being taken from every ton of ore. Iron is everywhere, but is not mined, the profit being too small.

Quicksilver has been discovered in large quantities in the northern part of the Transvaal, and as it brings $60 a flask at the gold mines, this find has proved a most lucky one.

Asbestos six feet in length has been found on the Orange River banks. It is coarser than the Canadian product, but is more valuable on account of its length. The Griqualand West Copper Company and the Cape Asbestos Company are mining the fiber at a profit. Mica exists in the Zoutpansburg, between the Selati and the Great Letaba Rivers. Salt is also plentiful, and especially so at Uitenhage, Cape Colony, where as much as 100 000 bushels have been mined in one year. It is also mined at Cradock and Bloemfontein. Sulphur in paying deposits is found at Tuli, Rhodesia. In Natal there are shale beds promising petroleum. Clay suitable for pottery, lime and kaolin are to be found in a number of places. Nitrate deposits have been located in the Doornberg Mountains, where they are said to extend for more than fifty miles.

Besides diamonds, other precious stones are amethysts, beryl, carnelian, garnets, olivines, opals, sapphires, topaz, tourmalines and turquoises.

Having delved into the mineral deposits of South Africa, it behooves me to say something of the results of these finds. Leaving out of the question the diamond mines at Kimberley, which are capitalized at $20,000,000 and which pay dividends of from twenty-five per cent to thirty per cent per annum, the total dividends of the gold-producing mines in 1896 was $7,450,000. In 1897 it was six millions more, and in 1898 it was $24,450,000. Among the dividend-paying properties in 1898 were:

Drietfontein, 25 per cent; Glencairn, 25 per cent; Knights, 30 per cent; Rose Deep, 40 per cent; Langlagte Estate, 45 per cent; Crown Deep, 50 per cent; Village Main Reef, 60 per cent; Geldenhuis Deep, 75 per cent; Durban Roodeport, 80 per cent; Bonanza, 100 per cent; Henry Nourse, 125 per cent; Geldenhuis Estate, 147½ per cent; Wemmar, 150 per cent; Crown Reef, 240 per cent; Ferreira, 300 per cent; Johannesburg Pioneer, 675 per cent.

The capitalization of these mines is as extraordinary as their dividends. The Simmer and Jack Proprietary is capitalized at $23,500,000. The Robinson (De Villiers) comes next with $13,750,000. Then comes the Randfontein with a mere $10,000,000 and the City and Suburban with a paltry $8,500,000. The latter paid fifteen per cent dividend last year.

But mining companies are not alone in this respect. There are a number of land, finance and exploration companies which can hold their own when it comes to a question of capital. The British South Africa Company, chartered, has a capital of $18,500,000, more or less watered, and used in the development of Rhodesia. The Consolidated Gold Fields, of South Africa, has a capital of $13,000,000. Of the banks, the Robinson South African Banking Company stands first with $15,000,000.

In some respects, the gold mines have been improved, especially in the cost of running and in the larger percentage of ore extracted. The following tables are from the office of The Transvaal Mining Engineer. The first table is illustrative of the economic progress of the Witwatersrand mines:

(One ton = 2,000 lb; one dwt. of gold = about 3s 6d.)	1889. 39 Companies.	1892. 74 Companies.	1895. 56 Companies.
Number of tons of ore milled	306,161	1,979,354	3,456,575
Average number of stamps at work	713	1,907	2,546
Crushing power of stamp per diem	.....	3·21 tons	4·14 tons
Gold obtained by milling (ounces)	369,557	973,291	1,501,623
Gold obtained by concentration (ounces)	.....	40,357	111,397
Gold obtained by cyanide process (ounces)	.....	160,168	638,732
Value of total production	£1,389,030	£4,297,610	£7,840,779
Proportion of same distributed in dividends	.....	19·4 per cent (£833,212)	28·8 per cent (£2,258,441)
Proportion of same spent on labor, machinery, development, depreciation, etc.	.....	80·6 per cent	71·2 per cent.
Total yield per ton of ore milled (all sources)	24·14 dwts.	12·65 dwts.	13·18 dwts.
Total inclusive cost of treating one ton of ore (also lowest grade at which ore could be worked without loss under existing conditions)	.....	10·20 dwts.	9·38 dwts.
Yield of gold per ton of ore from the mill	24·14 dwts.	9·77 dwts.	8·69 dwts
Yield of gold per ton of ore from tailings (cyanide)	.....	.....	4·63 dwts.
Net profit from one ton of ore as shown by dividends	.....	8s. 5d.	13s 0¾d

The second table shows the output for the same district during the same years:

	1889.	1892.	1895.
January	25,506	84,560	177,463
February	22,457	86,649	169,295
March	27,919	94,245	184,945
April	27,029	95,562	186,323
May	35,028	99,436	194,580
June	30,878	103,252	200,941
July	31,091	101,279	199,453
August	30,520	102,322	203,573
September	34,143	107,852	191,764
October	32,214	112,167	192,652
November	33,722	106,795	195,218
December	39,050	117,748	178,428
Total, ounces	369,557	1,210,867	2,277,635

But enough of mines—let us return to legitimate business. The principal industry is wagon, harness and saddle manufacture, of which there are about four hundred and fifty plants, employing three thousand hands. The annual importation into the colonies of this class of goods is about $400,000. The leather and leather goods imported are about $3,000,000. There are about a dozen small breweries, but their product is so bad that nearly half a million dollars' worth of beer and ale is imported yearly. Among other industries are printing and bookbinding, ship builders, oil and creosote works, furniture manufactories, ice plants, soap and candle makers, brick yards and potteries and one woolen factory.*

Most of the retail business is in the hands of Malays, and none of the stores are of enough importance to prevent successful competition. In fact, a real American store would be welcomed. The duties for the Cape Colony on principal imports are: Agricultural implements, 10 per cent ad valorem; cement, one shiling per hundred pounds; flour, five shillings per hundred pounds; cotton manufactures and drugs, 12 per cent; crockery and furniture, 12 per cent; haberdashery, hardware and hats, 12 per cent; iron, 10 per cent; jewelry, leather, linen goods and machinery, 12 per cent; canned meats, four cents a pound; spirits, 10s. 6d. per gallon; paper for printing, free; tea, sixteen cents per pound; tobacco (cigars $1 per pound and 10 per cent ad valorem); furniture, six cents per cubic foot woolen manufactures, 12 per cent.

In Natal agricultural implements are free; cottons are 5 per cent; hardware, 5 per cent; machinery, free woolens, 5 per cent. In the Transvaal machinery pays 1½ per cent ad valorem; tea, 5s. per hundred pounds; all books, printed matter and seeds are free.

The best investments for capital will be drygoods stores, manufactories for clothing and good restaurants. Goods that will be needed are hardware, clothing, agricultural implements, mining machinery, building materials, woolen goods, and about everything needed to dress man and woman.

The future of South Africa is bright with promise, and America's opportunity for obtaining the greater part of the trade is excellent. But it behooves Americans to "hustle," in order to be on the ground the day peace is declared, for the wily German and the pushing Hollander will be there, seeking to expand their respective trades.

So it remains entirely with the American business man to say whether we shall have another mart for our wares, or whether some competitor shall benefit by British aggressiveness and the Boers' sturdy stubbornness.

The accompanying pictures are fairly illustrative of the peculiarities of the peoples and incidentally of the country itself.

Pietermaritzburg, the capital of Natal, is a picturesque town, situated about seventy miles due north of Durban, the second seaport of South Africa. Interest is centered in it at present, because it is the headquarters of the expedition sent to the relief of Ladysmith. The peculiar two-wheeled vehicle, drawn by a Kaffir, is a jinrickshaw, imported from India and seen frequently in Pietermaritzburg.

The pictures of the natives are typical illustrations of the dress worn by the Kaffirs. Civilization has taught some of them to read and write, others to drink and gamble, but few of them can accustom themselves to the close confinement of civilized clothing. Even though extravagantly fond of bright colors and fancy ornaments, the average Kaffir prefers as little clothing as is consistent with a most liberal interpretation of the law. Still, in their case it is *honi soit qui mal y pense*, for they are generally overgrown, innocent-minded children.

The farmhouse is one of a type that can be seen in any part of South Africa, but more especially in the lower part of Cape Colony, where vegetation is more plentiful than it is further north. Cypress and orange trees abound, with few apple or pear trees, and scarcely any oaks.

It is a common sight to witness the "outspanning" of a team, as shown in one of the pictures. Nine out of ten settlements, whether village or town, are away from the railways, and coaches are necessities of intercourse with the outer world. From six to twelve animals, horses or mules, or a mixture of both, constitute a team. Relays are provided at the end of every hour's travel if it be a regular passenger coach carrying mail; if not, then exhaustion alone is the limit of a team's trip.

* These manufactories are small affairs and could not withstand active competition. Some of them employ only two or three hands.

Automobile News.

Motor vehicles will be a feature of the fifth annual Cycle and Automobile Show, which will open at Madison Square Garden during the week beginning January 20.

At last President Clausen has decided to admit automobiles to Central Park in restricted numbers, in order that horses may become accustomed to seeing them; and since Mr. Clausen has been out several times in an automobile and has run it himself, he has become quite expert in handling it.

The unaccustomed noise of an automobile in Prospect Park on November 21 was the cause of a stampede among some horses and the upsetting of a surrey in which two ladies were injured. The Park Commissioner of Brooklyn says that hereafter only experienced operators will be allowed in the Park with automobiles, and they will be confined to certain drives.

Trials of Torpedo Boat "Viper."

The Parsons turbine has again proved its ability to drive a torpedo boat at very high speed. On the official trial of the "Viper," a 325-ton destroyer for the British navy, equipped with compound turbines of 10,000 horse power, a speed of slightly over 32 knots, or 37 miles an hour, was realized at ¾ horse power. When she develops her full horse power, the contract speed of 35 knots will probably be realized.

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Science Notes.

A most interesting exhibit at the Paris Exposition will be that made by the United States Weather Bureau. It will be prepared under the personal supervision of the Chief of the Bureau, Willis L. Moore.

Prof. J. A. Brashear has developed some of the curved plates on which he photographed the sky one night recently when the meteors were expected to appear. While the night was very bad for photographic purposes, the pictures of the stars which he obtained were excellent. He said that they covered ten times the area that was possible with ordinary plates, and the pictures of the stars were well defined and continued clear to the edges of the plates. The time and labor which were expended in preparing to photograph the meteors was not wasted, because it was shown that curved plates are the proper thing for astronomical photography and have opened up new possibilities in this field.

A pendulum 300 feet long was used in the Masonic Temple, Chicago, November 12, for an experiment. Prof. Bevis, of the Armour Institute, demonstrated with its use the well-known experiment of Foucault. The deviation from the laws of gravity was demonstrated by means of the pendulum. This deviation is caused by the rotation of the earth, and in the few minutes that the pendulum swung it had begun to revolve in a horizontal circle, which would have been completed in thirty-six hours of constant motion had the heavy ball been allowed to swing that long. The weight and motion of the pendulum was neither accelerated nor retarded except by the influence of gravity and the atmosphere. Three hundred feet of wire was used in suspending the weight.

An attractive solution of the purpose of Stonehenge was put forward at the British Association recently. Dr. Alfred Eddowes, addressing the Anthropological Section, advanced the theory that the building was a gigantic sun-dial. The thirty great upright stones with their intervals showed, in his opinion, that the circle was divided into sixty equal parts, the grooved stone having been used for supporting a pole, which formed the pointer of a sun-dial for daily observation, or an indicator of the time of the year by the length of the shadow. Dr. Sebastian Evans, who presided, held that Dr. Eddowes had proved his point, that Stonehenge had been used as an observatory; but Mr. Arthur Evans protested against the attempt to introduce very precise and rigorous ideas into a rude monument; and contended that Stonehenge, which was on the site of an early Bronze Age cemetery, ought not to be regarded alone, but in relation to a large series of other stone monuments. One would like to know what is the date or period to which the oldest authentic sun dial can be attributed.

The Belgian Antarctic expedition has reached Antwerp. It was a private enterprise under the patronage of the Belgian government and was organized by M. A. de Gerlache, who commanded it. It sailed from Antwerp a little over two years ago, and the researches and discoveries made by the scientists who accompanied the expedition are now said to be of more importance than was at first supposed. The expedition explored Graham's Land, Palmer's Land, and Trinity Land. The voyagers remained for fifteen months in the South Polar regions, and during this period a number of magnetic and meteorological observations were recorded. The expedition returns with a fine collection of fauna, and what is said to be of the greatest importance, the material results of the deep sea research which formed part of the programme of the expedition. The deepest known soundings to the south of Cape Horn were obtained at a depth of 400 meters between that cape and the South Shetland Islands. The lowest temperature which was registered on their instruments was 43° below Centigrade, equivalent to 77° of frost Fahrenheit.

D'Arsonval has observed that pieces of rubber tube immersed in CO_2 under a pressure of one to fifty atmospheres swell considerably and absorb large quantities of the gas. The augmentation of volume is sometimes equal to ten or twelve times the original bulk, and the consistence is changed, the rubber becoming more gelatinous and less elastic. On being exposed to the air, the dissolved carbonic acid is gradually given off in small bubbles, which give rise to a distinct sound. CO_2 at atmospheric pressure rapidly passes through a rubber bladder, and escapes still more rapidly from a rubber bicycle tire. Oxygen, under like conditions, was found to behave in a similar manner. The air from a bicycle tire kept at constant pressure by means of an air pump was examined and found to be practically free from oxygen, and to consist solely of nitrogen. It is known that oxygen traverses thin sheets of caoutchouc much more readily than nitrogen, so that by simple filtration of atmospheric air, a gas containing 40 per cent of oxygen may be obtained. The author concludes that CO_2 passes through rubber by entering into solution with it, that oxygen does the same, but more slowly, while nitrogen remains longest under pressure in a rubber chamber.—Comp. Rend.

Engineering Notes.

A hundred bales of cotton were recently loaded into a box car 34 feet long, having a capacity of 50,000 pounds. The cotton was packed so tightly that there was space to put in five more bales.

According to The Engineering and Mining Journal, the value of the imports of precious stones at the port of New York in the month of October was $1,233,748; of this amount, $822,594 were uncut.

The smoke nuisance represents a loss of four or five million pounds sterling per annum in London alone, says The Builder, and no one can estimate the human suffering it entails by shutting out the invigorating sunshine and by poisoning the air.

The Baldwin Locomotive Works has just installed in its erecting shop a crane which has a span of 158 feet. It will lift a 196,000-pound locomotive 40 feet in the air, carry it 336 feet and set it down again in three minutes and thirty-six seconds.

Engine No. 1028 of the Reading Road has established a new speed record with a heavy train on the road running between Camden and Atlantic City. The distance is 55½ miles and was covered in 47 minutes, the average speed being 70·6 miles per hour.

The Delaware, Lackawanna & Western Railway Company has ordered four so-called "club" cars for their suburban traffic. They will be leased out to commuters for a fixed sum per year. This will insure the lessees having the same seats each day, if they so desire.

At Barrow, Messrs. Vickers, Sons & Maxim are making arrangements to house their employes. They will put up a thousand houses in a new village known as Vickerstown. This will be built on Walney Island, which is eleven miles long and one mile wide. A bridge will be built so as to give easy access to the works.

According to The Railway Review, the Tokio Card and Pasteboard Company, of Japan, is now experimenting with pasteboard as a substitute for roofing shingles. It is said that shingles of this material can be produced at a cost about 50 per cent cheaper than that of the wooden article. The pasteboard is made of the desired thickness and tarred to prevent the material from being affected by the weather.

The use of liquefied carbonic acid gas to extinguish underground fires has been dealt with by Mr. George Spencer in a paper read before the Institution of Mining Engineers. A fire occurred in a heading of a colliery with which Mr. Spencer was connected. It was decided to use carbon dioxide to put out the fire, and six cylinders of the liquefied gas were successfully used. In case of fire on shipboard the use of carbon dioxide might prove invaluable. It can be instantly applied and save much damage by water to the cargo.

The following is a suggestion for mounting plans on linen: Get a board or table sufficiently large to take the plan and tack the linen down with small tacks, of course minding that no creases occur in the linen. Get some common flour, to which add the proper proportion of water, and boil until the required thickness is obtained; with a smooth paint brush smear the linen evenly with the paste, taking care to leave no lumps on the surface; lay the plan to be mounted carefully on the linen, and with a handkerchief or soft cloth press the plan, making it tightly adhere. After this put the board aside for two days to dry, when the plan will be ready for trimming off with a sharp penknife.

On November 6 occurred an explosion of a calcium carbide furnace in the Dominion Carbide Gas Works near Ottawa. There was a fire in the neighborhood at the time, and the water flowed down into the carbide furnace. As a result the whole furnace blew up, injuring fifteen men. The carbide flew in chunks about the size of a man's fist, but one mass of carbide weighing a thousand pounds was blown through one of the factory doors. Eye witnesses of the catastrophe state that as the explosion occurred the building was filled with flames as well as smoke and the fumes of the carbide, and the people were almost overpowered. The fumes were so strong that the whole vicinity of the factory smelled strongly of the gas. According to The Railway Review, the force of the explosion was felt all over the vicinity.

A tunnel under the Bosphorus has been talked of many times. There is large traffic between the two sides of the Bosphorus and the delay caused by the opening and shutting of the bridge of boats which now forms the only connection is a great drawback. The railroad company is now constructing its lines on both sides, but this will not be of very great avail until the lines can be connected. Tunneling by the ordinary methods is hindered by the fact that the water is extremely deep and there is 20 or 30 feet of mud at the bottom. It has been proposed to suspend or float a tunnel some 35 feet below the surface of the water, thus allowing uninterrupted passage to vessels of even large draft. It is impossible to state whether this plan can be carried out or not. There seems to be great engineering difficulties in the way.

Electrical Notes.

It is stated that an attempt will shortly be made to connect Havana and Key West by the Marconi system of wireless telegraphy.

The Naval Academy at Annapolis has a new electrical library of 1,400 volumes presented to it by three alumni. It includes a number of rare books.

Articles of incorporation were filed at Trenton, N. J., November 22, of the Marconi Wireless Telegraph Company of America, with an authorized capital of $10,000,000.

On the trip home, Signor Marconi signaled to the station at the Needles while the vessel was sixty miles out. The terminal wire was fitted to the mast of the steamship for the experiment.

The Chicago, Burlington & Quincy Railroad has just commenced to equip locomotives with electric headlights. It was found that on trains traveling at a very high rate of speed a stronger light was necessary.

It has been suggested that the surplus power obtained by utilizing the gases of the blast furnace to operate gas engines might, in some instances, be advantageously employed in the manufacture of calcium carbide.

The London Tramway and Railway World have arranged for an international tramways and light railways exhibition, the first of its kind held in Europe. It will be held at Agricultural Hall, London, from June 30 to July 11, 1900.

The first use of Niagara power was as long ago as 1725, when the French erected a sawmill near the site of the present factory of the Pittsburg Reduction Company. It was used for the purpose of supplying sawed lumber for Fort Niagara.

Industries and Iron formulates many objections to the Nernst lamp. There is no automatic heating arrangement for the small-power lamps, and they require about eight seconds of artificial heating before they can be brought to incandescence. There are as yet no lamps of small candle power, and as each lamp has three wires, their connection is not always convenient. There have been no practical tests of the light of the lamp outside of the laboratory, and there are as yet no lamps of this design in commercial use. It is thought by some that the Nernst patent cannot be held valid, owing to the same principle being involved in the Jablochkoff candle.

The Electrical World describes an extraordinary phenomenon which has been noticed with regard to chestnut trees in a street in Brussels, since the installation of the electrical tram-cars. The foliage begins to turn brown and drop early in August, to bud and even blossom again in October. The trees on the opposite side of the tramway behave like ordinary trees, for they lose their foliage in the late autumn and do not put forth fresh blossoms until the spring. Botanists are inclined to believe that the cause of this singular state of things is due to the leakage of the electrical current at places underground acting upon the roots of the trees, which are otherwise quite healthy.

Under date of September 22, 1899, Consul Dudley, of Vancouver, informs the Department that the telegraph line from Skagway to Dawson has been completed and is now in operation. The nearest point to Skagway reached by telegraph, adds the consul, is Cumberland or Comax, British Columbia. It is stated that arrangements will be made for steamers to call at Comax to deliver messages brought from Skagway, and on their north-bound trips for messages to be delivered at Skagway. This places Dawson within about two and one-half days by telegraph. Mr. Dudley has also been informed that officers are at work surveying a line from Ashcroft, on the Canadian Pacific Railway, via Quesnelle, British Columbia, to Telegraph Creek, in the valley of the Stickene River. As soon as the survey is completed, it is expected that a telegraph line will be constructed; a branch line to Atlin, British Columbia, from Lake Bennett will also soon be in operation.

Peroxide of lead, when used as a coherer substance, shows the peculiar property of decreasing in conductivity under the influence of electric waves. This property has hitherto been held to disprove Lodge's theory of the coherer, based upon the formation of conducting chains by the welding together of successive particles. T. Sundorph has studied the behavior of this substance, and found that a cell containing PbO_2 powder transmitted a current of 8·5 milliamperes to begin with. After two minutes' exposure to electric waves, the current was reduced to 6·25 milliamperes, and after twenty minutes to 5 milliamperes. At the same time, the amount of PbO_2 was slightly reduced, but the author does not seem to be able to find the reason of this reduction. The only clew he gives is that PbO_2 contains some moisture, and this, of course, might be evaporated by the sparks. But whatever change takes place seems to be confined to the neighborhood of the terminals, and the positive pole becomes hotter than the negative pole.—T. Sundorph, Wied. Ann.

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SIMPLE EXPERIMENTS IN PHYSICS AND CHEMISTRY.

Experiment in Capillarity.—A crystallizing vessel having been filled with water to a depth of an inch or two, some mercury is allowed to fall into it from such a height that when it strikes the bottom of the vessel it shall rebound in the form of globules. Owing to surface tension, quite a large number of the globules will remain upon the surface of the liquid and will mutually attract each other with great force and at a distance of an inch or more. They will be strongly repelled, also, by any object wet with water that is made to approach them, such as a wooden match, for example.

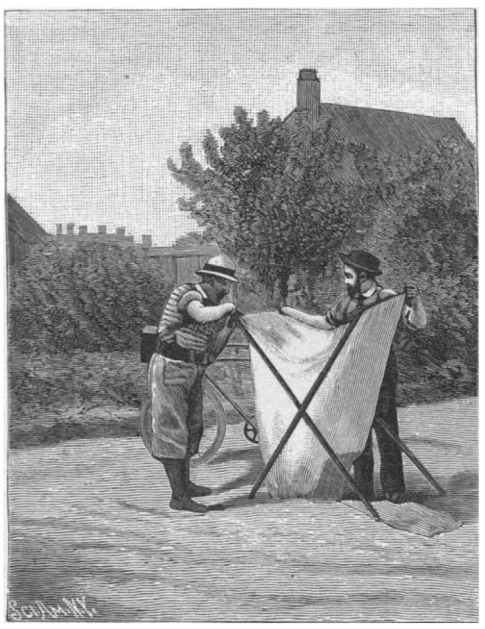

Fig. 1.—MOUNTING THE KITE.

Soft and Elastic Sulphur.—Some roll sulphur is melted in a Florence flask, with very gentle heat, over a Bunsen burner. It is well to remove the flask from the burner before the complete melting of the brimstone and to stir the latter until the fusion is perfect. The flask will then contain sulphur in a very plastic state.

Then the flask is submitted to heat again and the melted sulphur vigorously stirred. After a while the substance will pass abruptly to a pasty state. Such passage from one state to the other does not take place instantaneously unless the sulphur is vigorously stirred, but occurs gradually.

Experiment with Hydrosulphuric Acid.—Some hydrosulphuric acid is ignited at the extremity of a tapering tube which, through a rubber tube, communicates with a Woolf bottle in which the gas is produced. Upon moving the flame over the surface of some water placed in a pan, sulphur will deposit upon the liquid and thus permit of writing a name, drawing a design, etc.

Phosphureted Hydrogen.—A few fragments of calcium phosphide are allowed to fall into a goblet containing some water, and quite a thick layer of sawdust is immediately spread over the surface of the latter. The bubbles of phosphureted hydrogen accumulate beneath the sawdust in forming one very large bubble, which finally lifts the sawdust, bursts, and forms a series of rings of extraordinary size.

Preparation of Nitrogen.—A bell glass is provided with two metallic combs facing each other and communicating with the poles of a Ruhmkorff coil or a Holtz electrostatic induction machine. Some phosphorus is burned in the bell by the ordinary process. The cupel that contains it is supported by a cork that floats upon the water in which the bell glass rests. As soon as the phosphorus has been completely burned, a silent discharge of electricity is passed through the combs. The electricity immediately precipitates the fumes of phosphoric anhydride, and after this the bell glass will no longer contain anything but pure nitrogen. We would advise the use of a bell glass provided with three apertures, one at the top and two at the sides. The one at the top will serve for collecting the nitrogen when the bell glass is made to descend into the water, and those at the sides will serve for holding the metallic rods of the combs.—A. Bleunard, in La Nature.

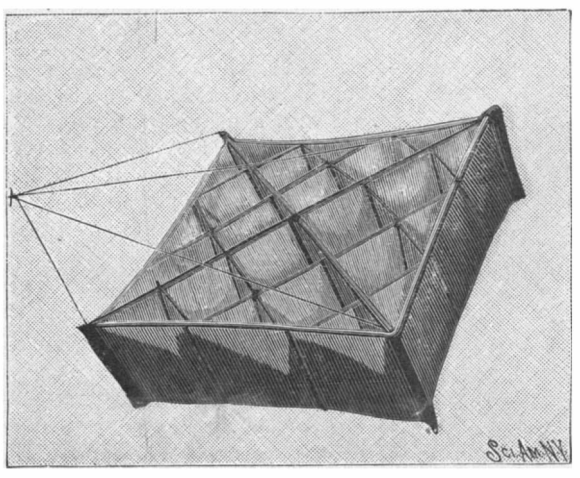

Fig. 2.—THE LECORNU CELLULAR KITE.

THE LECORNU CELLULAR KITE.

There is no amusement more fascinating, more instructive or more easily engaged in by everybody than kite-flying. Although it is much in favor on the other side of the Atlantic, it is yet too much neglected in France. Almost everywhere in the United States, there are to be found kite clubs analogous to the French bicycle and photographic societies, and which are in the habit of organizing competitions of various kinds. It is a great pity that the sport is not indulged in in France as much as it deserves to be, for the kite is a wonderful apparatus, of which a host of curious and interesting applications may be made. It is almost without a rival for the study of atmospheric electricity and for topographic photography. It may be employed as a life-saving and signaling apparatus, for the practice of wireless telegraphy, for the study of meteorology, and even, as with the balloon, for making ascensions. The ordinary kite is familiar to every one. Whatever be its form, lozenge-shaped, rectangular, elliptical, hexagonal, octagonal, etc., it always consists of a plane surface provided with a bridle to which the string is attached, and with a tail of varying length. This last-named appendage was for a long time looked upon as indispensable, and it seemed as if a tailless kite could not be thought of. But the Oriental kites imported from China and Japan destroyed such an opinion.

Fig. 3.—RAISING THE KITE.

If we attentively examine the tailless Japanese and Chinese kites we shall see that they are no longer plane, but either (like the Japanese flies) consist of a plane part and two wings forming pockets and inclined toward the rear, or, (like the Chinese apparatus) present curved surfaces. This, in fact, is because the plane kite is unstable. It is like a plank that we should like to keep in equilibrium in a current of water, and at right angles therewith, in holding it by a single rope. It is evident that however carefully we fixed this rope at the center of the thrust, the board would be in a state of unstable equilibrium and would continually revolve around its point of attachment. It would be entirely different if we should fasten a string to the handle of an umbrella and present the concavity of the latter to the current. When we study the stability of the tailless kite, we are thus led to seek forms that are entirely different from those of the flat kite.

Without extending this brief statement of the question any further, we shall merely say that one of the best forms to adopt for the tailless kite is the cell. We mean by this the form obtained with at least three, but generally four planes intersecting each other in pairs according to parallel straight lines. We thus obtain a sort of bottomless box. The walls are of paper or of some light fabric. To make the matter plain, let us conceive of a cell of square section. This will present itself in the form of a box of which the four sides

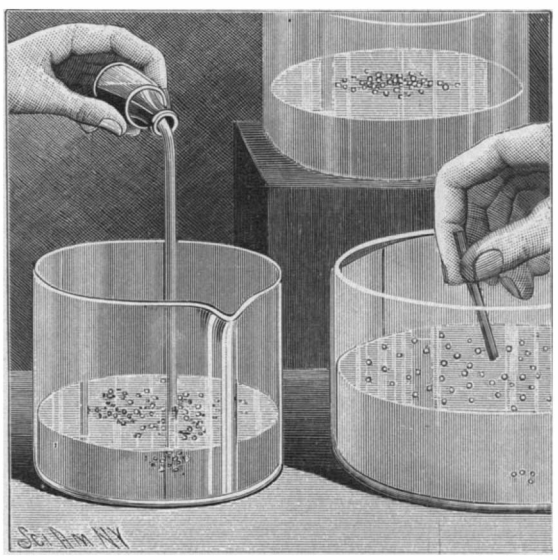

Fig. 1.—EXPERIMENT IN CAPILLARITY.

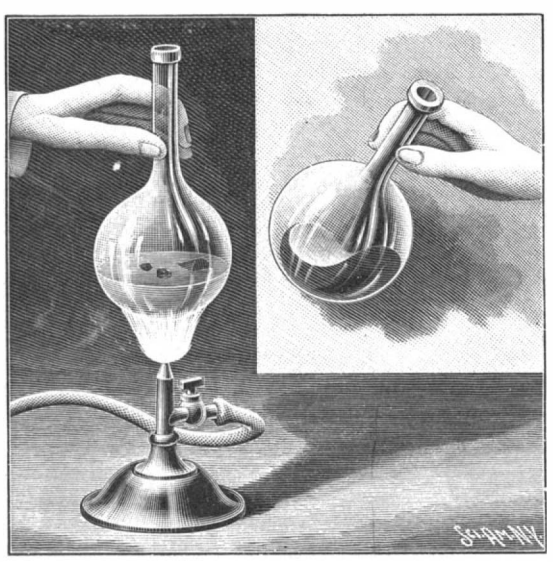

Fig. 2.—EXPERIMENT WITH SULPHUR.

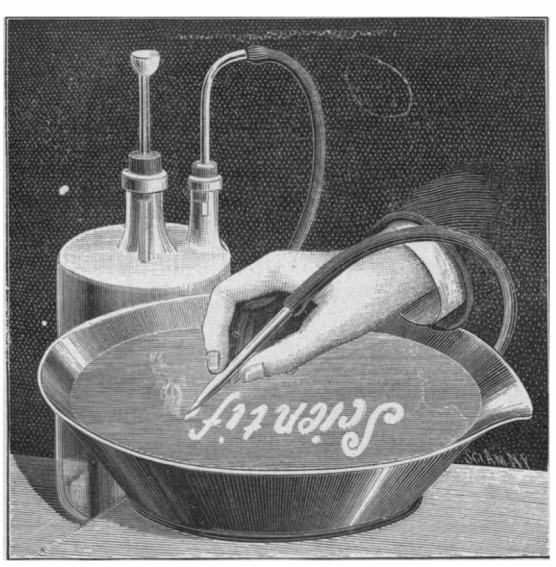

Fig. 3.—WRITING UPON WATER WITH HYDROSULPHURIC ACID.

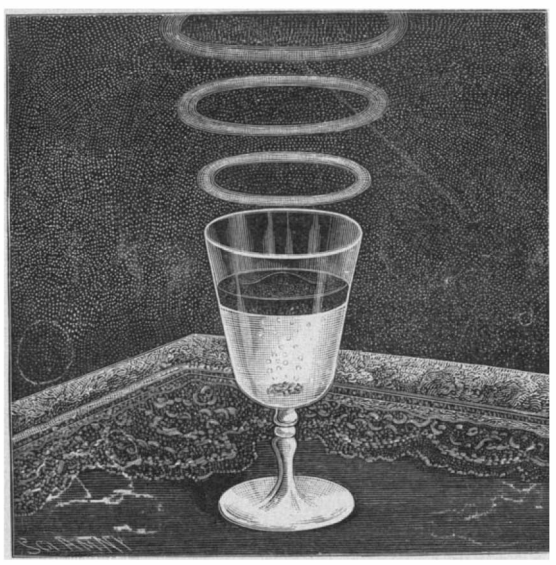

Fig. 4.—RINGS PRODUCED BY PHOSPHURETED HYDROGEN.

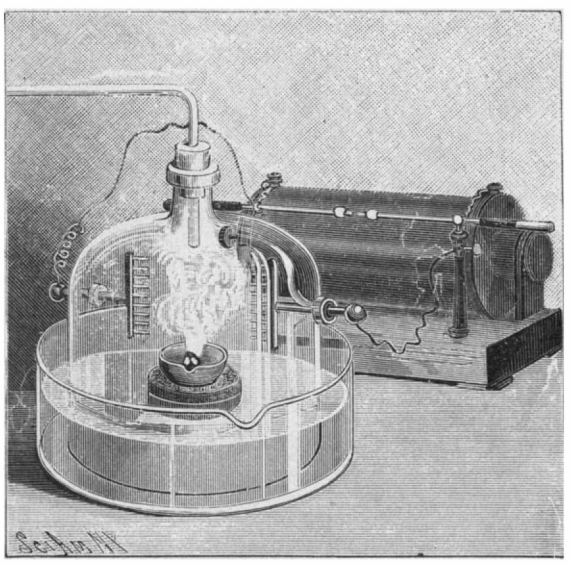

Fig. 5.—PREPARATION OF NITROGEN.

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will exist, but of which the top and bottom will be suppressed. If we present this cell to the wind in such a way that two of the sides shall be horizontal and two others vertical, it is evident that the air will pass freely through the cell without exerting any pressure capable of raising it; but if we elevate the front edge of the cell slightly, the wind, in pressing the lower surfaces of the walls that were previously horizontal, will tend to raise the apparatus. The latter will have great stability by reason of the existence of the two vertical sides, which, in a manner, play the same part as the keel of a boat.

The sides of the cell that undergo a pressure are the sustaining planes, and the vertical sides the directing ones. If we place two of these cells one behind the other, in leaving between them an interval equal at least to their length, we shall have the Hargrave cellular hovering kite adopted at the Blue Hill Observatory (in the United States), where through the intermedium of meteorological registering apparatus, it is used for exploring the upper regions of the atmosphere. In certain experiments, such apparatus have reached heights of from 5,000, to 6,500 feet.

If, on the contrary, we juxtapose not two but a greater number of cells, say six, eight, twelve, or more, in the same frame, we shall obtain the multicellular hovering kite, which we have devised and constructed after numerous tentatives.

We at the outset placed four rectangular cells one above another, and thus obtained an apparatus having exactly the form of a set of shelves. We tried this upon the beach of Cobourg in 1898; but, since the stability did not prove as great as that which we desired to obtain, we were led to multiply the number of cells and to employ square cells, with one diagonal and horizontal and the other vertical.

Each cell taken isolatedly thus flies upon the side and presents to the wind surfaces that are inclined, one to the right and the other to the left, somewhat as in the case of a boat that is floating upon its keel.

We have in this way constructed a kite of wonderful stability, which rises with the greatest ease and maintains itself in the air with complete immobility.

Our multicellular hovering kite is very easily constructed. It requires as a rigid frame only four wooden rods having the length of one cell and placed at the four corners of the entire affair formed of all the cells, and two cross pieces, one in front and the other behind to give rigidity to the whole.

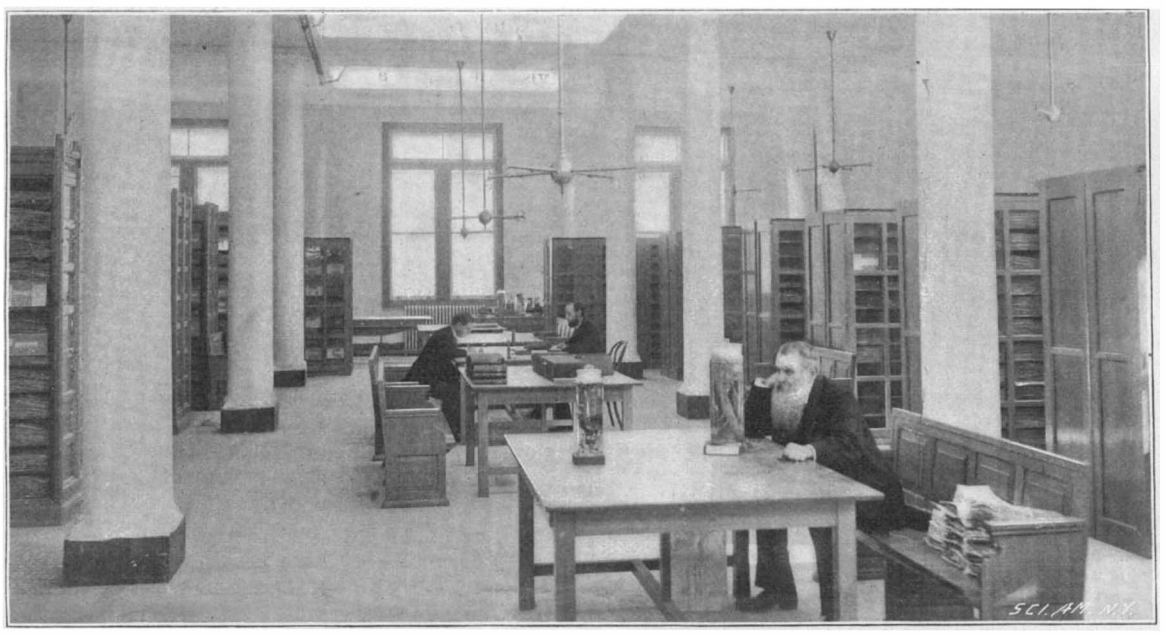
It may be put together and taken apart in a few minutes with the greatest ease. After being taken apart, it may be rolled up and carried very easily upon a bicycle.

It is so easily managed that any one can send it aloft and maneuver it without difficulty. When it is in the air, it is so stable that ten yards of string may be suddenly paid out without causing it to fall. Finally, its sustaining power is so great that, in a brisk wind, we have been able to make it raise a dummy formed of a child's clothing and fixed to an umbrella. And yet the kite is not of very large size, its dimensions being four feet in length and breadth and 16 inches in depth, while its weight is a little less than four and a half pounds.

We are indebted to La Vie Scientifique for the description of this form of kite.

THE NEW YORK BOTANICAL GARDEN.

New York city is fortunate in having within its corporate limits a park which contains both a botanical garden and a zoological park. Until within a comparatively short time there were few visitors to Bronx Park, notwithstanding the fact that this tract with its thick woodlands, waterfalls, glens and rustic bridges, is really one of the choicest parks in the country. Its chief merit is that in no sense does it resemble the ordinary park. The Botanical Garden part does not show the imprint of the landscape architect. It is the purpose of its managers to leave the paths as rugged as at present, and only the main arteries of travel will be macadamized and made easy for visitors. The Park is readily reached from the Grand Central Depot by the Harlem Road, and the visitor breaks his journey at Fordham for the Zoological Park and at Bedford Park for the New York Botanical Garden.



VIEW OF HERBARIUM, MUSEUM OF BOTANICAL GARDEN.

In 1889, a committee of the Torrey Botanical Club was appointed with authority to procure such legislation and funds as would be necessary for the establishment of a botanical garden in New York city. This committee succeeded in securing the interest and cooperation of the city authorities and of many influential private citizens. The provision of the charter, which was obtained in 1891, and was amended in 1894, was that a corporation should be established from which a board of managers was to be chosen, supplemented by an ex-officio board of scientific directors to have the management and control of the scientific and educational departments of the corporation. The Mayor and the President of the Board of Commissioners of Public Works were also to be members. Upon the corporation securing by subscription a sum of not less than $250,000, the Commissioners of Public Works were directed to set aside and appropriate a portion of the Park land not exceeding 250 acres for establishing and maintaining a botanical garden and museum and to construct and equip within such grounds suitable buildings at a cost not to exceed $500,000. It was also provided that the grounds should be opened to the public daily without charge. The sum of $250,000 was raised by subscription, and on July 31, 1895, the Commissioner of Parks appropriated 250 acres in the northern part of Bronx Park for the purpose of the corporation. About two years were then devoted to the preparation of the plans and the preliminary improvement of unsightly portions of the tract. $500,000 for buildings was made available by vote of the city authorities in the summer of 1897, and the buildings were commenced about the end of that year. The result of the co-operation of the municipal authorities and private individuals has proved most satisfactory in the American Museum of Natural History and the Metropolitan Museum of Art, and the new enterprise in Bronx Park in which the city is a partner will prove no less interesting and valuable to the citizens at large and to science.

The section of the Park given to the city is admirably adapted for the purpose of a botanical garden. It is not too far away to be accessible and is still out of immediate contact with the smoke and vitiated air of a great city. Every variety of growth finds a fitting habitat in the land reserved for the garden. There are broad meadows for the grasses, bogs for the sedges, flags and other plants, and clear running water and quiet lagoons for aquatic vegetation. There are tree-shaded lowlands for ferns and scattered rocks and ledges for mosses and lichens. The tract through which the Bronx River now flows will be left intact for the benefit of the students of forestry, and since Lorillard built a large stone house on the east bank of the gorge a century and a half ago, the trees have been almost totally undisturbed by the ax of the woodman.

The popular features of a botanical garden are not omitted, and as soon as the visitor enters the ground he begins to see the labels attached to trees and plants throughout the garden. The various classes of trees and plants into which the garden is divided are termed "plantations." The swampy forest land is being drained, but will be reserved as a forest area, as these forest features are considered of the greatest importance in the general plan. West of this is the fruticetum, a plateau consisting of 3 or 4 feet of loam resting on a layer of gravel 12 feet or more in depth. This is divided into sections for the planting of shrubs according to the family and following as far as possible a natural sequence and grading broad levels of greensward between the families. Beyond this are the bog gardens and the portion devoted to plants like the willows. South of the fruticetum and bog gardens are some springs forming a bog. This bog is to be excavated to a depth of 6 feet and converted into lakes separated by a longitudinal driveway. There will be a water area of 6 acres when all the

THE MUSEUM OF THE NEW YORK BOTANICAL GARDEN.

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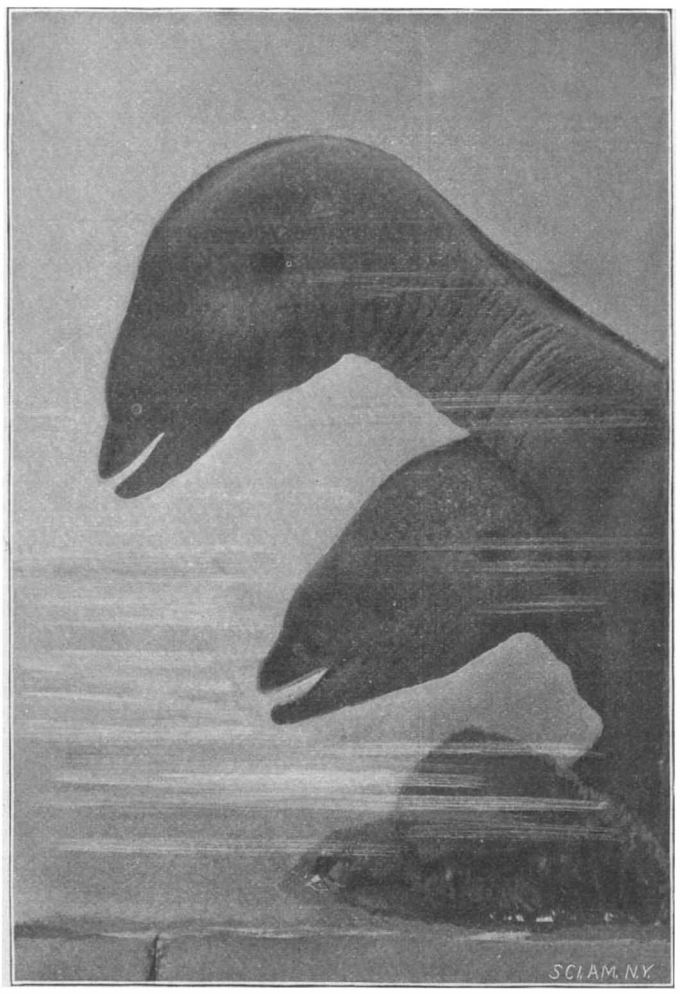
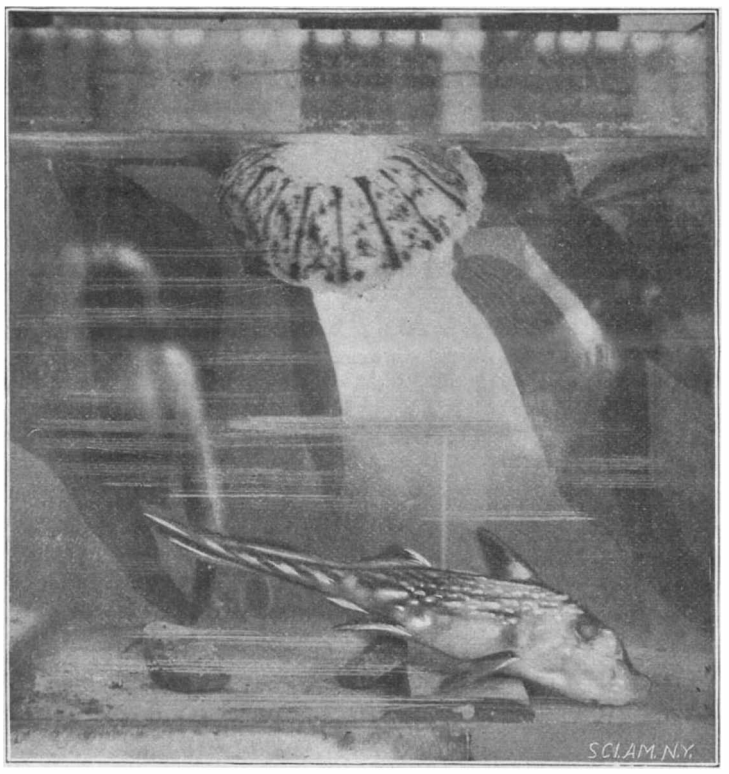
various improvements are completed, irrespective of the Bronx River. About the museum 25 acres of land have been reserved for ornamental purposes. South of the museum is a glade devoted to the systematic display of a collection of herbaceous plants. It is a meadow intersected by a stream and bordered by trees.

In this space provision is made for hillside plants and those which thrive best in the shadow of woodlands. Upward of 5,000 plants have been set out and labeled, and already the plantations afford a valuable opportunity for study. The Pinetum west of the herbaceous grounds has been stocked with many fine specimens of pines, firs, spruces, and larches.

The museum building is at present the most interesting feature of the Garden. It is 308 feet long, 50 feet deep, and 70 feet high. The building is designed in the Italian renaissance style, and the classic order used is limited to two stories because these are the chief portions of the structure and are thus appropriately marked in their external character, and the upper story is thus left susceptible of freer and more varied treatment. The central feature is the dome of the reading room, which rises higher than any other part. The whole stands upon a basement which is masked by the approaches and terraces; thus the apparent height is lessened and the skyline varied without injury to the utilitarian interior. The materials are of white brick and terra cotta with the exception of the marble columns. The principal entrance is on the first floor level, so that all of the public museum halls are up only one flight of stairs. This is accomplished by forming a terrace along the main front of the building reached by an inclined approach. The first floor of the building is devoted to economic botany and the specimens will include samples of barks, fibers, food, plants, timber, etc., the object being to show the plant and tree and fruit or product at all its various stages. The process of manufacture will be illustrated either by charts and diagrams, or in some cases by models. Such apparatus as a cotton gin will be shown on a small scale with the raw material and the varied products. On the second floor of the building is the Museum of General Botany where types of each of the various families will be shown. The exhibition will be of a synoptic nature arranged with a view to pedagogical effect.



LIVING FISH IN THE SANTA CATALINA ZOOLOGICAL STATION.



COLORED JELLY FISH AND FISH PHOTOGRAPHED UNDER WATER.

The third floor of the building is arranged for investigation purposes, with a library in the center. In the rotunda under the dome is the main reading room; adjacent is the stackroom, provided with metallic shelves capable of containing twenty thousand volumes. To the west of the library is the laboratory for plant embryology and cytology. Adjacent to this is the general morphological laboratory, the Director's office and a seminar room; adjoining and on the northwest corner is a specially constructed room with greenhouse for plant physiology, and an elaborate heating system makes it possible to secure any desired temperature. Research rooms, chemical laboratory and a photographic laboratory are on the west side of the floor. At the end of the library there is a large laboratory and various research rooms. Another east wing is occupied with a herbarium shown in our engraving, which is already equipped, as the large herbarium in Columbia University is in place with cases and specimens in perfect order. It is fitted up with oak tables and chairs, and is an ideal place for botanical study. It now contains between 600,000 and 700,000 specimens. In the library the Columbia University Botanical Library will be installed in the course of a few weeks, and the garden has also acquired on its own account some valuable collections of books. The lecture room in the basement is practically complete and is arranged in the amphitheatrical form and will accommodate 720. In this room public lectures under the auspices of the garden will be given from time to time on botany and allied subjects.

Outside the museum building work is being carried on in the way of grading, planting, drainage, etc., vast quantities of porous tiling being used for drainage purposes. A 36-inch water main running through the grounds has been tapped for a 6-inch main, thus providing an adequate water supply, for it is necessary to use vast quantities of water in summer in order to promote the healthy growth of the plants. The power house is located directly on railroad and it will supply heat to the museum and the range of horticulture houses. A subway carries the steam pipes and electric wires from the power house to the museum.

Opposite the museum and fronting the Southern Boulevard are the horticultural houses. When completed they will be thirteen in number and will cover an area of 45,000 square feet. The central feature of the range is a palm house with a diameter of 100 feet, and it is nearly 90 feet high. From each side of the houses connecting wings 116 feet long and 30 feet wide will extend east and west. These houses have a cruciform termination, being 84 feet wide, 16 feet high to the main cornice, 38 feet to the lantern cornice, and 46 feet to the ridge. There will be various other connecting greenhouses. These houses are largely constructed of glass and the work on them is proceeding very rapidly. Palms, ferns, and tropical fruits will form a feature of the taller houses, while one of the low connecting houses will cover a pond for the aquatic plants. Heat will come from the power house which supplies the museum. The garden staff, which is already doing most efficient work, is under the direction of Dr. Nathaniel L. Britton, to whom we are indebted for courtesies in the preparation of the present article. The members of the staff are Dr. D. T. Macdougal, director of the laboratories, Dr. John K. Small, curator of the museums, Dr. P. A. Rydberg, assistant curator, Samuel Henshaw, head gardener, and there are other assistants.

PHOTOGRAPHING LIVING FISHES AT SANTA CATALINA ZOOLOGICAL STATION.

BY PROF. C. F. HOLDER.

The islands of the Southern California group, especially Santa Catalina, which has a town and mail service to and from every day in the year, have long been an interesting field to the zoologist, the fauna being in many respects peculiar. The "Albatross" has dredged here, and doubtless the National Museum has a very perfect collection representing the deep sea life of the adjacent channel and the submarine plateau that reaches away from the various islands. To place the representative forms of life here within reach of the public, students, and teachers, the owners of Santa Catalina Island have opened a zoological station and equipped it with a very creditable aquarium, so being able to present to the teachers of the National Educational Association, which met in Los Angeles, a fairly representative collection of the marine animals of this region, few, if any, of which have been seen or displayed alive.

The aquarium is on the beach at the little town of Avalon, which is 3½ hours from Los Angeles. The present building is 60 by 20 feet with an end room for purposes of study. The tanks consist of one 60 feet in length, which can be used as a single tank or divided into ten or twelve compartments; this faces the sea. In the center of the building is a shark tank, 40 feet in length, with one division. In one end of the room are several small tanks, while the west or land side is also occupied by a row of small tanks 3 by 4 feet. The water is pumped from the bay to large reservoirs about 150 feet above, and from there runs down and is distributed by the injectors which aerate the tanks.

The conditions here are almost identical with those of Naples, only the climate at Avalon is almost perfect, the temperature ranging not much over 10 or 12 degrees between winter and summer; hence the dangerous changes which threaten some aquariums are reduced to a minimum. On entering the aquarium a tank of corals is first seen. Here is a beautiful branching scarlet gorgonia brought up in the channel from 600 feet of water, a large and heavy branch of coral and an attractive glass sponge from the same depth. The floor of the tank is sandy and on it are the "sea pansies" of the layman, or renellas cousins of the corals, throwing out long white polyps. The coral Dendrophyllia is seen here; the polyps when alive are a rich sulphur yellow. A line of small tanks follow, all tastefully arranged with living algæ. In the first are two remarkable fishes known as "drums," from the fact that they utter a loud grunting sound that can be heard all over the building though made under water. They are about a foot in length, the eyes directed upward, as in the case of the star-gazer, and on the lower surface and sides is a remarkable arrangement of mother-of-pearl spots apparently like those of Scopelus, also found here. The next tank is devoted to the great keyhole limpet, its velvet black body concealing the shell and in sharp contrast to the great yellow foot, almost 6 inches long, that is fastened to the glass.

In the adjoining tank are young rock bass, their beautiful eyes an interesting study. Then comes a tank of the smallest of the surf fishes—the shiner; a family group that was born here in the latter part of June. Like others of this family of fishes, they were born alive. The parents are four or five inches in length, and the young at present an inch and a half long. Each female gave birth to six or eight young, which were expelled tail first, and were at once capable of taking care of themselves, making no attempt to follow the mother, though they schooled. These little creatures are very tame and readily feed from the hand. The young males are beginning a unique courtship, which consists in penning a female in a corner and darting about her, pretending to seize food with open mouth and carry it to the demure female that remains in a given position. The male observed at this time drove off all rivals. The autumn—September and October—is the so-called mating time. In the following small tanks are young marbled morays, kelp fishes and some singular deep-sea spider crabs that were taken from a depth of six hundred feet. To all intents and purposes they are dead, so slow are their movements.

In the center of the hall is a long tank filled with macrocystis and various algæ, in the center of which is a notable group, consisting of three or four marbled morays—huge creatures of great bulk, veritable sea serpents, their mouths open, showing sharp fanglike teeth. Swimming up and down about them is a young sheepshead, rock bass, curious kelp fishes that mimic the leaves, and others. Two large sting rays press their grotesque faces against the glass, provoking much amusement from those to whom they are new.

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The most interesting features of this tank are the Port Jackson or horned sharks, the group comprising old and young, male and female and eggs. They are types of a very ancient race, and thrive well under all conditions. The eggs are peculiar corkscrewlike objects of horn, which in the winter are washed up by every storm. Adjoining this tank is one containing bass and perch of various kinds, and next to this a larger tank with mussels and crayfish--the local lobster. A smaller tank is given over to a giant of the tribe whose shell was thrown off but a few days ago. From here extends a series of tanks whose occupants would delight the eye of an Eastern naturalist. Here is the king of the sculpins, so called, the great dink and marbled bullhead; then a compartment carpeted with Serpulæ of hues of the rainbow, their spiral breathing organs twisting and winding, disappearing and reappearing like magic. With them is the graceful Virgulia, dredged from the deep sea, dozens of interesting Terebratulæ, with pink shells and pseudo-skeleton within.

Then comes a tank of young "Garabaldis," illustrating the difference between old and young fishes in color. The adults are pure deep red, the young golden red, with blue splashes and dots so iridescent as to give rise to a popular local name, the "electric fish," many fishermen believing that they have seen sparks and flashes from them. Here is a series of the Southern California sheepshead T. pulcher, from the adult males confined in separate tanks to prevent them from fighting, to the young. The old fish is a striking object, its blunt head pure black, its lower jaw pure white, a deep red band in the central portion, and the tail black. The very young one is a pale pink with black spots on its dorsal and anal fins—a brilliant little creature. The next stage it is all pink, the eye spots having disappeared; then in a larger fish some are fiery red, some white; still larger the stripes or bands are fairly outlined. Following are tanks of large black echini, the big California red crab, the giant spider crab of this coast, holothurians with plant-like breathing organs, all decorated with the delicate kelps and weeds peculiar to this region. In a large tank is massed a school of angel fishes, and in a still larger one a mola or sun fish lazily fans itself, while several dogfishes from the deep sea and a yellow-tail nearly four feet long eye it suspiciously.

In the jelly fish tank a Rhizostoma stretches away like a comet, and various delicate forms are seen, such as the torepods, a long chain of salpæ, physophora—the latter one of the most beautiful objects seen here; its rapid movements and lovely coloring assuring it much attention. Floating on the surface of several of the tanks are velellas with glossy sails and deep blue tentacles. The mollusks are extremely interesting. Perhaps the most showy, seen from time to time, and at short intervals, are pterotrachia and carinaria, attaining large size, pteropods of several species, which cling to the weeds and are remarkable mimics, as doris, tethys, and aplysia, the latter feeding from the hand, taking the rich green ulva with avidity.

Several species of haliotis cling to the glass or rocks, and a trochus shell, covered with a deep orange sponge, moves slowly, while the marbled bulla, or bubble shell, leaves a curious silken web as its great foot glides along. A rare spinned murex, boatshells, aviculæ, oysters, mussels, mytilus, and others are seen feeding upon weed or kelp. A small tank contains a group of ascidians from deep water bottoms, forms with rough surfaces in strange contrast to the elegant salpæ. Among the corallines are retepora and others, and the living polyps of dendrophyllia in sulphur yellow tints are fastened to various shells and the large tubes of worms. In the starfish tank is the large form, thirteen or fourteen inches across, common here, a deep red starfish. Asterias and several snake stars, ophidium and others; the last named being difficult to keep alive.

Among the interesting experiments here have been efforts to keep the deep sea "rock cod," and the yellow-tail, Seriola dorsalis. The latter is a very active fish and rarely survives longer than a week. They are so common that they can be frequently replaced.

It has generally been considered well nigh impossible to photograph the fishes in an aquarium, but some fairly successful plates have been made here by Mr. N. Swenson, of the mottled moray, the chimera, the sheepshead and others. True, they are not so perfect as could be desired, but are excellent when it is remembered that it is a difficult matter to induce fish to pose. The morays opened and shut their mouths, the sheepshead moved its fins, but the chimera was photographed without any trouble. The chief difficulty was in keeping out the reflections, which appeared as white spots.

This is the first aquarium and attempt at a zoological station in Southern California, and the first time the marine fauna has been seen alive. The exhibit has been visited last summer by many students and teachers of natural history, and the institution will become a valuable adjunct to the school system of Southern California.

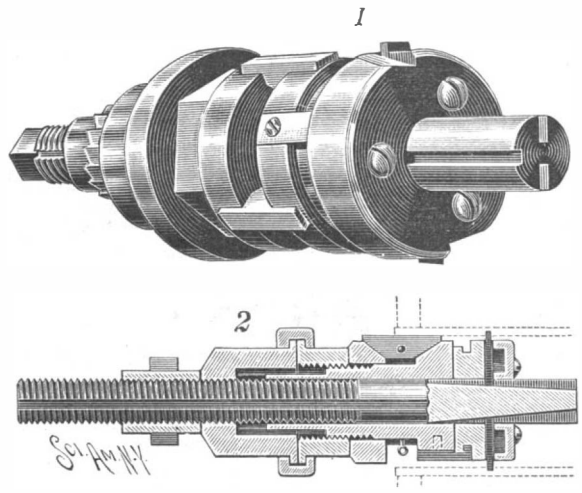
AN IMPROVEMENT IN FLUE-CUTTERS.

The flue-cutter which we illustrate in perspective and section was invented by Mr. Philip J. Kruger, of Greenville, Ill., to fill a want for a device by means of which a flue could be cut at the inner side of the sheet without forming a bur, thus leaving the flue in perfect condition to have a piece welded on the end, so that it could be used again.

The cutter comprises a central screw-shaft provided with inclined channels to receive the ribs of the cutter-carrying head. Owing to this arrangement the cutter-head is free to rotate with the shaft; and the shaft has longitudinal movement through the head. Cutters carried by the head are adapted to be moved outward by a longitudinal movement of the shaft and inward by a spring. The shaft is mounted to rotate in a sleeve on which clamping-blocks are supported by a spring-ring. On the sleeve a ring is mounted for forcing the blocks outward, which ring is in turn forced longitudinally by a nut engaging a feed nut on the shaft. The abutting portions of both units are engaged by a locking collar. A second sleeve removably engaging the shaft but rotating therewith has ratchet-teeth on its outer side, which may be engaged by a suitable tool to turn the shaft. This second sleeve brings the torsional strain upon the shaft nearer the cutters than in most similar devices.

In operation the cutter is placed sufficiently within the flue, as shown by dotted lines in Fig. 2. By rotating the sleeve-nut, the sleeve-ring is forced forward, causing the clamping-blocks so firmly to bind against the interior of the flue that the slightest movement of the sleeve and connected parts is impossible. Then by rotating the central shaft, to move it inwardly, the inclined walls of the channels will gradually force the cutters outward as they are carried around with the head.

The inventor has subjected his cutter to severe tests



KRUGER'S FLUE-CUTTER.

and has found that flues can be cut with a gratifying dispatch and facility.

Water-Plants as Land-Winners.

In The Naturalist for August, Mr. Albert Henry Pawson makes a brief contribution to the study of the influence of water-plants on the land surface. "There are several ways in which these plants tend to diminish the water-space and to increase the dry land. By their own decay they form vast masses of vegetable soil in shallow waters and on water margins; by occupying running streams they moderate the flow of the current and give it time to deposit its silt; by their creeping rhizomes and spreading roots they fix the bed of a stream and prevent its being scoured and deepened by floods, and again in times of flood they serve as a sieve or strainer, arresting all floating and much suspended solid matter." This is indeed a familiar theme, but the author discusses it with freshness and with appreciation of its dramatic interest. "Inch by inch, as the result of this accumulation and decay, the land creeps in upon the mere; more and more solid grows the edge; the aqueous plants retreat from the now shallow margin, the terrestrial plants advance, finding firmer footing; the sedges and reeds crowd on their floating neighbors which need space, and cannot endure the shade; these, too, press forward, and the open water grows less and less; it is invested on every side, and it is plain that its complete subjugation is now only a matter of time." It would be of interest to procure some actual measurements of the amount and rate of land-winning, and to study in minute detail the elimination which proceeds as the mere is closed up.

A BLUE grotto like that of the island of Capri has been discovered on the shore of the promontory of Skinari on the Ionian island Zante. The entrance is from the sea, and is larger than in the Capri grotto, but the interior is smaller. Fishing boats can make their way in when the water is calm.

Correspondence.

A Suggestion to High Speed Railroad Engineers.

To the Editor of the SCIENTIFIC AMERICAN:

Railroad engineers who travel at a high rate of speed are painfully aware of the peculiar and trying effect upon the nerves of the eyes, caused by objects on the side of the tracks which in effect flash by them, and distract the gaze, which should be fully concentrated straight ahead.

To obviate this, and at the same time relieve the strain on the optic nerves caused by these distracting influences, let the engineer wear a pair of short tubes, say of about three-quarters of an inch in length and painted a dull black on the inside, over the eyes.

These tubes could easily be constructed of some light substance, and made to fit like ordinary spectacles.

Besides the restful effect these tubes produce on the eyes, they at the same time render the vision wonderfully clearer by cutting off all diverging rays of light. ARTHUR SMEDLEY GREENE.

Port Jefferson, L. I., November 9, 1899.

The Funafuti Expedition.

The Funafuti Boring Expedition has very recently led to the rectification of a common ethnographical error, and the discovery of an interesting fact in zoo-geography. In the monograph on the atoll of Funafuti published by the Australian Museum, Sydney, Mr. E. R. Waite referred to a large undetermined fish known to the natives as "Palu," and to traders as "Oil-fish." According to Mr. Louis Becke, a full-grown Palu would weigh up to 150 pounds and be 6 feet long; the average size is about 3 or 4 feet, and weight 40 to 60 pounds. The natives have many superstitions in regard to Palu; every portion of it is edible, even the head and bones when cooked turning into a rich mass of jelly. The flesh of the Palu, if left uncooked, never putrefies; it simply dissolves into a colorless and odorless oil. Perhaps the great regard the natives have for it is due to the fact of its being a rapid and powerful purgative. It is a deep-water fish, and is usually caught at a depth of from 120 fathoms down to 200 fathoms; the fishing is only done at night. The Palu fishing hook has been described by Mr. C. Hedley, who points out that this large hook, which is widely distributed in the Central Pacific, and may be seen in most ethnographical collections, has been described by all authors as a "shark-hook." The last expedition to Funafuti has been fortunate enough to obtain a specimen of this fish, and in an appendix Mr. Waite has solved the riddle, and found that this mysterious fish is the well known Ruvettus pretiosus, which hitherto was known only from the North Atlantic, and whose recorded range is now enormously increased. The Escolar (Atlantic name) has been taken at depths as great as 300 and 400 fathoms, but can be taken only at night in September and the early part of October. —Nature.

The Current Supplement.

The current SUPPLEMENT, No. 1248, is a most interesting and valuable one. The first article describes "A Unique Departure in Engineering Education." The article illustrates the ceramic school of the Ohio State University, of which Prof. Edward Orton is the director. It is accompanied by illustrations showing the work being actually carried on. "Causes for the Adoption of Water-Tube Boilers in the United States Navy" is by Rear-Admiral George W. Melville, Chief of the Bureau of Steam Engineering, U. S. N., and is an important paper dealing with the advantages and disadvantages of such boilers. "The Modern Armor-Clad" is the first installment of an article illustrating in detail the actual construction of a battleship or armored cruiser. "Designs for the 'Denver' Class of Sheathed Protected Cruisers" is by Rear-Admiral Philip Hichborn, Chief Constructor, U. S. N., and gives in detail his views regarding the class of cruisers with which our readers have already been made familiar. "Krupp Armor-Plate Tests" describes important tests. "Effect of Hydrocyanic Gas upon the Germination of Seeds" is an interesting paper by C. O. Townsend. "A Problem in American Anthropology," by Prof. F. W. Putnam, is concluded. "The Explosive Side of Acetylene" is by F. H. McGahie.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CULTIVATOR.—Daniel G. Burkhardt, Dayton, Wash. By reason of the improved construction devised by this inventor, each of the ground or supporting wheels of the machine can be independently adjusted, so as to enable the driver to raise or lower the other end of the machine-frame or both ends simultaneously. The frame is light and simple and is constructed of wood or angle-steel.

REVOLVING SULKY HAY-RAKE—Amos R. Black, Parkdale, Colo. The rake is designed speedily and cleanly to rake heavy crops, damp hay, or green alfalfa. In connection with the wheels, a revolving sleeve is used, to which spring rake-teeth are secured, which are adapted to bear on the ground. Rigid, radial arms are fixed to the sleeve; and lever mechanism is adapted to bear on the arms, thereby temporarily increasing the pressure and tension upon the teeth in action.

COVER FOR HAYSTACKS.—Samuel G. Rayl, Tunis, Iowa. This cover for haystacks is formed of separable sections provided with stringers projected beyond one of the sections and respectively running in the planes immediately adjoining the planes of the stringers of other sections and having lateral engagement with the stringers of the sections. The sections may be adjusted to form a cover of any size desired.

Engineering Improvements.

REVERSING-VALVE FOR ENGINES.—Aloys Haferkamp, Duisburg, Prussia, Germany. The method of regulating the speed and work of the reversing rolling-mill engine is imperfect, because the high-pressure steam cannot be utilized as much as possible by allowing it to expand. The present invention employs a sliding-valve with Allan's or Trick's channel and provides a second set of steam-ports in the valve-box or cylinder besides the usual first set. The first set admits high-pressure steam to the cylinder when the engine is running as usual; while the second set serves to admit the steam to the cylinder on reversing the engine should the cranks be in an unfavorable position. The sliding valve works with either the first or the second set of steam-ports.

PIANO ACTION.—John H. Bell, Lawrence, Kans. Heretofore the only yielding of the mechanism of a pianoforte action has been due to the slight condensation which takes place in the felt used at points of contact between the different parts. To avoid this objection, the inventor interposes a spring between any two parts of the action and transmits motion from one of the parts to the other. The spring improves the touch by making the action more pliable under pressure; the durability of the instrument is increased by preventing the severe shock which many parts are compelled to bear in the use of the old construction; and the tone is improved.

CUPEL-MACHINE.—Albert C. Calkins, Los Angeles, Cal. In assaying by cupellation, the alloy of precious metal is placed in a shallow vessel made of bone ash and is heated in a current of air which oxidizes the lead and other impurities and allows them to be absorbed by the vessel of bone-ash. This machine is a new, practical device for rapidly compressing the bone-ash into the form of cupels and shallow vessels. The machine comprises a plunger jointed to a lever having two separate fulcra-bearings, one of which comes into action during the first part of the stroke to give a powerful compression, and the other of which comes into action during the last part of the same stroke to discharge the compressed cupel.

RAISING OR LOWERING APPARATUS FOR MINES, ETC.—David Davy, Broomcroft, Parkhead, England. The invention comprises an elevator composed of a pair of endless chains having cages slung therefrom. Guides cause the cages to deviate from the plane of the chains and to assume a position midway between the ascending and descending members of the chains on reaching the landing stage at the top and bottom of the shaft. The cages hence remain for a sufficient period at the dead points of their motion to permit their being loaded and unloaded, although the chains continue in motion.

DRILL FORGING AND SHARPENING MACHINE.—William J. Evans, Butte, Mont. The device consists of two forming-dies composed of a tenoned block horizontally channeled across its working face, the back wall of the channel being sloped to widen it toward the rear end. A fuller projection is located on the lower edge of the working face of the die and has its upright face sloped from the rear forwardly. To renew the cutting edges it is necessary only to heat the drill-body and introduce it between the dies so as to enter two of the drill-wings in the channels. The reciprocation of all the dies spreads the wings at their free ends to normal width, and at the same time sharpens the dull edges. The drill is changed in position by rotation so as to bring all the wings successively into the channel.

Railway Appliances.

LOCOMOTIVE-BOILER.—Cornelius Vanderbilt, Jr., Manhattan, New York city. It is the object of this invention not only to enable the boiler to resist the strain due to expansion and contraction, but also to provide a more effective heating-surface so as to obtain a very rapid generation of steam. This end is attained by the use of a special fire-box cylindrical in cross-section and placed eccentrically in a fire-box section. The rim of the fire-box is transversely corrugated. The axis of the fire-box section is inclined to the horizontal to reduce the water-space below the fire-box line at the rear end of the box: and the forward end of the fire-box is submerged to a less extent than the rear end so as to increase the effective heating-surface and obtain the rapid generation of steam mentioned.

Miscellaneous Inventions.

SHOULDER-BRACES AND SUSPENDERS FOR STOCKINGS.—Ellen Rouse, 57 Lancaster Gate, London, W., England. These combined shoulder-braces and suspenders for stockings and other objects of children's and ladies' wearing apparel fulfil the function of a shoulder-brace calculated to promote an erect carriage without causing discomfort. The device is readily adjustable to suit figures of different degrees of fulness and height and is capable of yielding to all movements of the body.

GAUZE-CARRIER.—Clinton Tyng Cooke, Hutchinson, Minn. The inventor has devised an instrument especially designed for introducing gauze into cavities of the human body for the purpose of drawing away fluids contained therein. The instrument will rapidly, firmly, and in many cases painlessly pack gauze into cavities and wounds in such a manner that the gauze will not come into contact with the superficial walls of the cavity until it reaches the desired point. The gauze is thus introduced aseptically.

TEMPER-SCREW.—James J. Davin, Washington, Pa. The invention avoids the necessity of the set-screw generally passed through the clamping-socket as the only means of holding the rope or cable while drilling oil-wells. The swivel-bar is directly linked to the C-socket or clamp-socket, and the rope-clamp is independently connected with the swivel-bar. The clamps are so fitted in the socket that they will be secured against lateral movement and may be quickly placed in position in the socket or removed therefrom.

TEMPORARY ACCOUNT-BOOK.—Robert W. Hamilton, San Diego, Cal. The book is designed to receive loose account-slips or the like in alphabetical order so that they may be readily found at the end of a month when the ledger is made up. The book comprises main and auxiliary leaves. The auxiliary leaves properly indexed serve to subdivide the alphabetical index so that the account-slips of different persons whose surnames begin with the same letter can be separated as much as possible.

FOLDING-SEAT.—Henry S. Kidd and Michael H. Depue, Washington, N. J. This invention consists of a small, light seat provided with rockers and so constructed as to be readily folded and packed in a small space. The legs of the seat are somewhat S-shaped and are disposed in pairs, the legs of each pair crossing at approximately right angles and being pivoted and locked together. A rung at the pivotal points connects the pairs of legs. The legs are also fastened together by two cross-pieces from which the canvas seat is stretched. A folding detachable back, suitably braced, forms part of the seat, and may be thrown into or out of use.

APPARATUS FOR EXTRACTING PRECIOUS METALS FROM ROCK, SAND, ETC.—James F. Latimer, Toronto, Canada. The apparatus consists of a receiver having a hopper bottom provided with a valved outlet and a valved inlet. Mounted on the receiver and having a contracted opening in its top, is a cylinder provided with two outlets and one inlet. Water admitted through the inlet rises through the narrow opening in the bottom of the cylinder and passes out through the outlets carrying off the lighter impurities and scum at the top and the heavier ones at the bottom, while the gold or other ore falls into the hopper of the receiver.

SANITARY ATTACHMENT FOR TELEPHONE TRANSMITTERS.—William Lenderoth, Manhattan, New York city. This simple invention consists of a wire frame having a ring and bent arms which clamp it on the front of an ordinary conical transmitter. Three wires project forward from the ring forming a cage in which is inserted a temporary paper cone which may be removed and destroyed after the telephone has been used.

LAMP-CHIMNEY AND MEANS FOR SUPPORTING SAME.—Albert S. Newby, Kansas City, Mo. The invention, which is intended for lamps with incandescent mantles consists in surrounding the burner with an asbestos band having indentations in the bottom of the chimney where it contacts with the asbestos. By this arrangement the chimney is held firmly on the burner and is not liable to break from contact with the heated metal, while the descending rays of light are not obstructed, as in the usual burner.

CALENDAR ATTACHMENT FOR PENHOLDERS OR PENCIL-CASES.—George N. Vitanoff, Sophia, Bulgaria. The invention consists of a circular metallic case that can be slipped on the end of a pen or pencil, in which case are three drums on which are marked the day of the week, date, and month. The drums are rotated by turning serrated disks. A fourth drum carries a tape on which is printed a miniature calendar.

STRINGED MUSICAL INSTRUMENT.—Frank L. Patch, Phillipsdale, R. I. The instrument has a flat pear-shaped body and a hollow handle with a finger-board on its face fitted with the usual string-tightening keys. A U-shaped knee-rest is attached to the bottom and a hand-rest is placed beside the strings at the bridge, which projects slightly over the opening in the body. A set of springs on the bottom of the bridge project a short distance parallel to the strings and carry on their ends a transverse-rod provided with small balls. By tilting the instrument properly, the balls are brought into contact with the strings and give a tremulo effect. By making the handle hollow, the vibrating power of the instrument is greatly increased.

FIRE-ESCAPE.—Thomas J. Nichols and Harry N. Tennille, Manchester, Va. The apparatus consists of a circular car tapering beneath a flooring. In the conical bottom thus formed is placed a small windlass upon which a rope is wound. The end of the rope passes over a pulley on a bracket fastened to the building and is secured to the floor of the car. One end of the windlass drum is provided with notches in which a holding-dog may engage, and an automatic brake-shoe also operates on the drum. The descent is made by pressing a button in the floor with the foot. The brake can be regulated by the pressure on the button.

ADVERTISING-APPARATUS.—James C. Powell, 299 Eighth Avenue, Manhattan, New York city. The object of this invention is the displaying of a series of advertising sheets at stated intervals. The invention consists of a square operating-shaft hung horizontally at the top of the frame and driven by a clock-train. An endless apron consisting of slats suspended from the operating-shaft carries a series of advertising banners connected at their ends so as to form an endless belt around the apron, and flexible connections are provided between the middle of the banners and the apron, so that the banner, when displayed, drops suddenly into view.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(7764) N. E. R. asks: Can you furnish any papers on the construction of accumulators or storage batteries for 110 volt incandescent lighting? A. No different accumulator is required for this purpose, only a larger number of cells, and, if the surface is for a long time between charging, a larger size of cell. A practical storage cell was described in Supplement, No. 1195, price 10 cents. We do not however recommend amateurs to undertake to build a storage battery for the sake of saving money. It is probably cheaper and certainly better to buy from regular dealers a well-made battery.

(7765) F. A. M. asks: 1. How can I coat the iron tip of a circuit breaker that dips in mercury cup with mercury? A. Try rubbing the clean bright iron with bichromate battery solution, at the same time applying the mercury. Better replace your iron contacts with platinum, and the trouble will disappear. 2. What book have you on alternate currents that deals with its relation to impedance and capacity in series and parallel? A. The best book for a beginner in electric science to read is Thompson's "Elementary Lessons in Electricity and Magnetism." Price $1.40 by mail. 3. Also, what work of reference on chemistry, organic and inorganic, do you recommend? A. We recommend and can supply Bloxam's "Chemistry, Organic and Inorganic. With Experiments." Price $4.50 post paid.

(7766) C. B. asks for the plans of a 1 horse power motor to be run on a 500 volt current. A. We have no plans for the motor you describe. Such machines present special difficulties in construction, with the insulation, for example, so that they are beyond the resources of the ordinary amateur. We should not advise the attempt to construct one, except in a well-equipped electrical shop, in which place our plans would not be needed.

(7767) C. L. W. asks: Have the phrases "as many again," and "twice as many" the same or different meanings? A. These two phrases have exactly the same meaning, as a reference to any dictionary will show.

(7768) J. P. S. asks: What is the highest practical speed at which a one horse power gas (or oil) engine may be run? To obtain one effective horse power at above speed, what size cylinder and length of stroke must be used? Also to what per cent should compression be carried? One explosion every two revolutions. Would it be necessary to use a water jacket on cylinder, or will corrugations exposed to air be sufficient for cooling? What will be the approximate average pressure, using gasoline for the explosive mixture? A. All speeds up to 1,000 r. p. m. have been claimed by makers and operators of explosive motors. The higher speeds may have been realized when the motors are running light or not doing work; 300 to 500 revolutions per minute is our experience with such motors doing normal work with compression about 40 pounds per square inch. The size of cylinder varies greatly according to the required speed; say from 4×5 inches to 5×6 inches. Water jackets have been dispensed with where air can be utilized over ribs on the cylinder for increasing the surface, mostly for vehicles. An average pressure of from 40 to 60 pounds may be realized by the proper vaporization and air mixture.

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NOVEMBER 21, 1899.

AND EACH BEARING THAT DATE.

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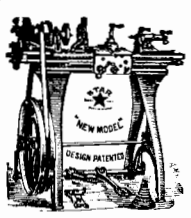

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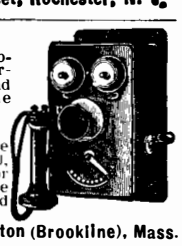

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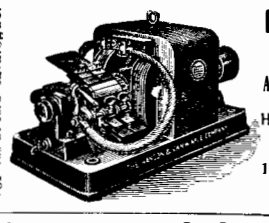

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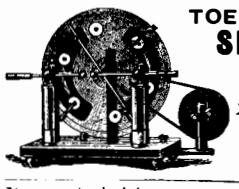

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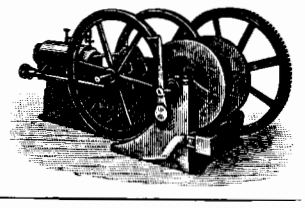

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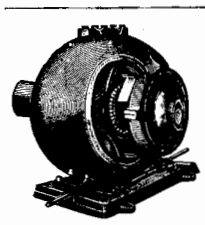

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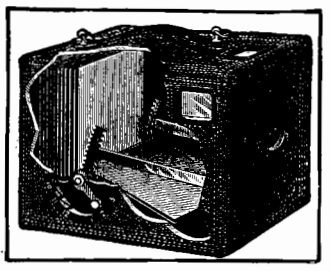

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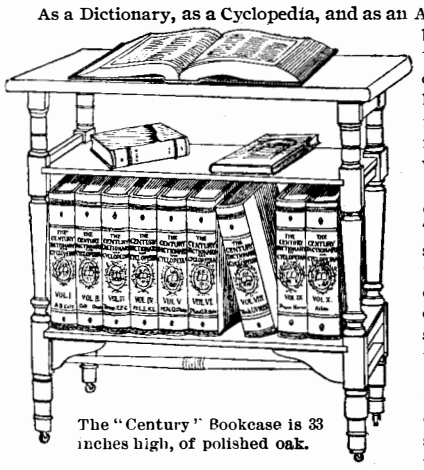

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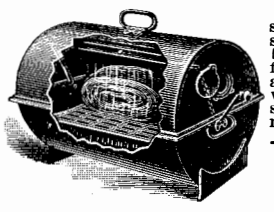

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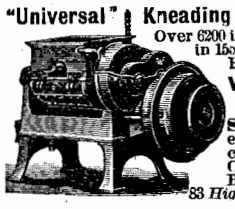

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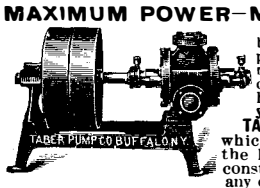

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PROPOSALS.

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NOTICE TO CONTRACTORS.

November 9, 1899.

Proposals will be received by the Commissioners of the New East River Bridge, at their office, at No. 49 Chambers Street, in the Borough of Manhattan, in the City of New York, at two o'clock in the afternoon of the 7TH DAY OF DECEMBER, 1899, endorsed "Proposal for Construction of Steel Cables, Suspenders, etc., of the New East River Bridge," for furnishing the materials for and constructing the steel cables, suspenders, cable bands, coverings, sheaves and their appurtenances of the New East River Bridge, in accordance with the proposed form of contract and the drawings and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to Lewis Nixon, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the said Commissioners on that day at two o'clock in the afternoon.

Copies of the specifications and the general drawings for the work, with the proposed forms for the bid, bond and contract, may be seen and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Borough of Brooklyn, City of New York, on and after the 13th day of November, 1899.

The Commissioners require that all bidders shall carefully examine the specifications, drawings and proposed form of contract, in order that no question as to their meaning may arise hereafter. It must be distinctly understood that no changes in the quality of the materials or of the workmanship will be allowed, and that the specifications will be adhered to strictly.

The contract is to be completely performed within ten months after the cable saddles are set in place upon the steel towers of the bridge.

Proposals will be made upon a form provided therefor, and only those proposals will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal in the office of the Commissioners, a certified check for $12,000, payable to the order of Julian D. Fairchild, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract and the giving of the required bond, if his bid is accepted, within two weeks after notice of the acceptance of his bid.

The Contractor will be required to give a bond in the penal sum of $400,000, in the form annexed to the proposed form of contract, with an approved surety company doing business in the City of New York, conditioned for the prompt and faithful performance of the contract and its covenants and the work thereunder.

As by far the greater part of this work can be executed only by bridge establishments of the first class, bids will be received only from such parties as have the requisite plant and facilities which have been in successful operation on work of similar character for at least one year. The bidders must be, in the opinion of the Commissioners, fully qualified both by experience and in appliances to execute work of this character and importance according to the highest standard of such work at the present time.

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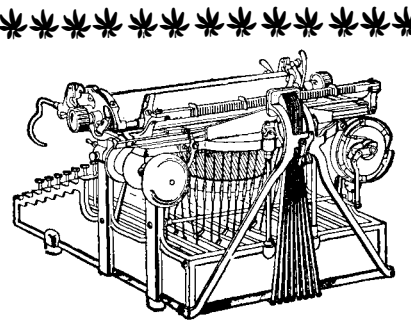

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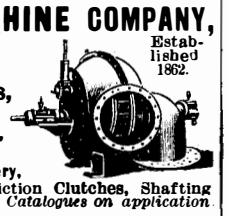

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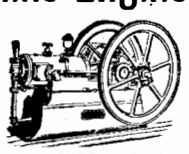

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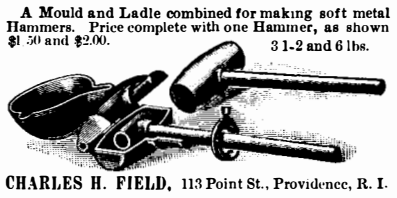

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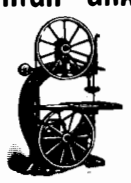

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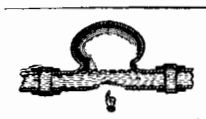

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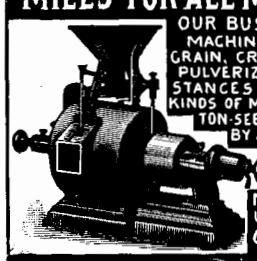

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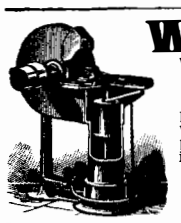

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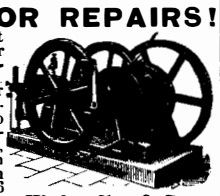

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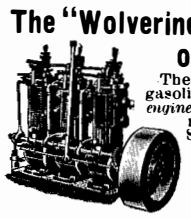

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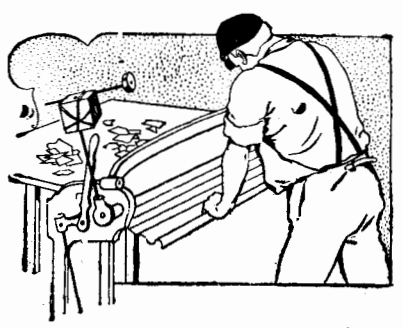

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